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DECEMBER 24, 1936

THE IRON AGE

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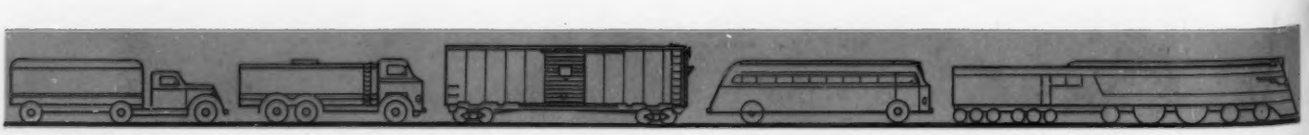

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THE IRON AGE

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...THE IRON AGE...

DECEMBER 24, 1936

ESTABLISHED 1855 Vol. 138, No. 26

The Age of Chivalry

IT is said that there is nothing new under the sun, but some people doubt the truth of that statement. While admitting that strikes are as old as the hills, they say that the "sit down strike" is certainly a new development.

The sit down strike first came into prominence during an altercation, not many months ago, between the workers of the vulcanizing department of the Goodyear Tire & Rubber Co. and its management. Instead of going out on the street and forming picket lines to keep workers from getting into the plant, the strikers adopted the simpler expedient of sitting down at the machines and staying there.

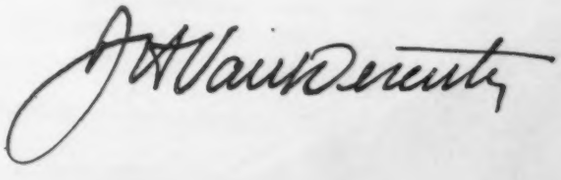
Not long afterward, the French, who are great admirers of American ingenuity, adopted this "Akron" plan for their general strike. It was found to be quite effective and the factor of novelty furnished the "element of surprise" which is said to be an invaluable part of military strategy. French industrial executives had had plenty of experience in dealing with the more vociferous labor controversies in which cobblestoned streets acted as ammunition dumps for embattled workers. They did not know how to handle a "sit down."

It is pretty hard to decide just what to do when people report for work and then just sit down and don't do it. The German workers found that out some time ago. In Germany strikes are illegal under Hitler, but the workers in that country have gotten around it through the practice of "Die Arbeit klebt an Hand" as they call it, or "slow motion" production.

American management is handling the sit down situation rather skillfully. In one recent instance, steam was obligingly kept on by the management during a sit down strike so that the strikers would be comfortable and not catch cold. In several cases recently, matrons or chaperons have been provided so that no breath of scandal should attach to the feminine element during a more or less prolonged absence from domestic firesides.

If we must have strikes, perhaps the sit down method is as good as any. It does not result in broken heads or windows, nor does it involve the recruiting of flying squadrons, either of pickets or of strike breakers.

After all, if workers have a grievance against the boss, it is better to take it out in sitting down than to take him to the nearest river and drown him, as told of the ancient Chinese in the "Golden Hours of Kai Lung."



A BLAST furnace such as the one opposite, does an excellent job of transmutation—for a comparatively useless red earth emerges as a molten stream of marketable metal. Nevertheless, whether the furnace be of this older type casting into sand or a more modern unit with auxiliary strands of molds, much improvement is possible. Perhaps the shape could be altered to advantage, or a double bell should be employed or the efficiency might mount through the use of sized material in the charge. Photo by Barrow Haematite Steel Co., Ltd.

RANDOM THOUGHTS of an IDLE STEEL MAN

o o o

By FRANK H. CROCKARD

o o o

LAST week the author sketched the technological changes in the making of steel in this country, and, also, the accompanying changes in the types of products produced and the influence these products had on consuming industries. The need of a more liberal dissemination of the results of international research was mentioned, and a number of wasteful procedures incident to the making of steel today were listed. In this, the second and last section of Mr. Crockard's paper, a number of practices are detailed and discussed, each of which could conceivably cheapen and simplify operations in the steel mill of the future.

Specific items which in the opinion of the writer would contribute to further economies in the cheaper production of iron and steel follow. Some of these could be made effective at once, while others will require considerable research.

Coke:

Utilization of the heat now wasted in coke discharged from ovens.

Use of a superior coke secured by lower ash and sulphur content, as a result of coal washing.

The ammonia fixation in coke oven gas in a form other than ammonia sulphate.
Oven insulation.

Reduction of the sulphur content of coke during coking as a post coking operation.

Blast Furnace:

Adoption of a more satisfactory method of stock distribution in the furnace after leaving the main bell.

General application of the isolated practice of stock charges composed of sized ore, stone, and coke.

Reduction of flue dust.

Higher stove temperature.
Dry blast.

Adoption of the largest type of blast furnace in plants which can profitably do so without loss of flexibility.

Blooming Mill:

Partial displacement of the blooming mill as a result of

the development of an extrusion process.

Open Hearth:

Development of a technique affording much more rapid reactions.

Bessemer:

Greater attention to the increased production of bessemer alloy steels, and the further use of the converter as indicated hereafter.

The underlying thought in connection with these suggestions is based upon the assumptions that existing tonnage capacity is in excess of consumer requirements; that the era of cost reduction through increased production no longer offers the possibilities of past decades; that quality in physical requirements including tolerances and surface finish is increasingly exacting; that service as represented by delivery and helpful technical cooperation with the fabricator is highly desirable; that greater attention directed to the development of more precisely controlled operations, resulting in time, energy or material savings offer attractive possibilities in cost reduction in which finished products of increasingly superior character may be profitably offered at prices no greater, or no less than those of present standards.

In such approaches it is clear that considerations relating to the attainment of these objectives must also embrace interests precedent and subsequent to that of the immediate function. For example, improvements at the blast furnace resulting in the production of pig iron of more uniform quality either with reference to chemical or physical character may or may not show a saving at the furnace, yet the advantages flowing from the use of iron more uniform in temperature and chemical composition including very low sulphur content, could very easily result in savings of great importance in the ingot or rolling mill. While high sulphur can be cooked out in the open hearth, the process is slow and costly because of slag metal surface contact only. There is no specific item in the cost sheet indicating the excessive cost due not only to the use of additional materials, wear of bottoms, roofs and ports but also the longer shop time required and the disturbing

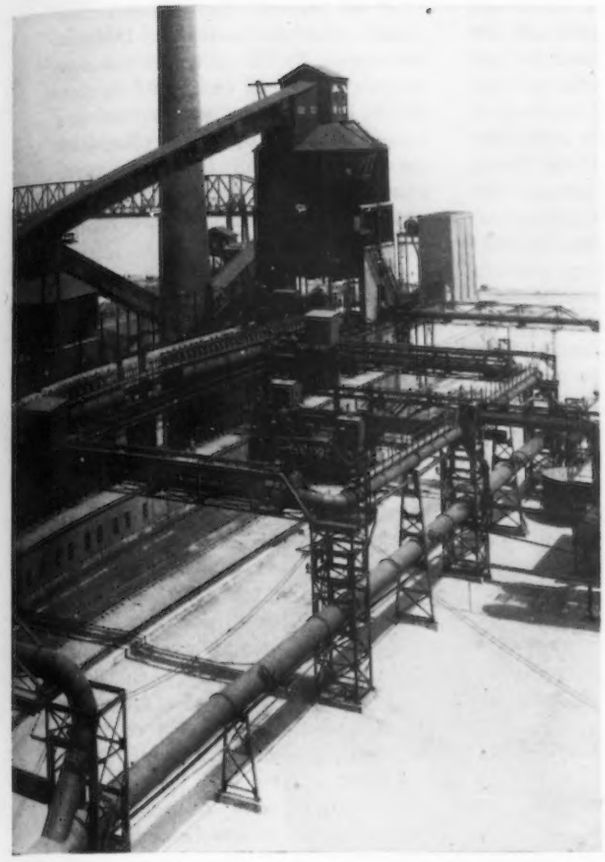
effects of such variable furnace practice. These basic facts are recognized by those directly engaged with production problems, but their correction is not always within their control. Within this field are many fascinating problems in which the pursuit and control of the molecule will prove as profitable and glamorous as were those of mechanization and tonnage. One reads and hears so much of the establishment of ultimate boundaries of all kinds, the passing of pioneer days and the lack of further opportunities, etc., that it is at least gratifying to know that in the iron and steel industry we are just "beginning to commence."

Blast Furnace Dimensions

For clarification purposes some of the generalizations listed are deserving of further expansion. In the case of the blast furnace it required about 10 years to move from a 14-ft. hearth to one of 18 ft. Another movement in 1924 presented the 22-ft. hearth, which again expanded to 28.5 ft. by 1930. The ultimate diameter is still undetermined. With this great hearth expansion there was not a proportionate increase in stock line, the disadvantages of which were twofold: The stock volume in the upper stack sections was decreased with relation to greater hearth activity and did not give sufficient time for the most economical preparation of the ore, while the greatly increased gas volumes passing through a relatively constricted outlet, resulted in higher gas velocities with the accompanying increased flue dust losses.

There was hesitancy in changing the almost standardized clearance of 2 ft. between the bell periphery and stock line inwalls. To do so would greatly affect the distribution of coarse and fine with reference to the furnace walls and the center stock column. The dust losses reached 350 lb. per ton of iron and in some instances were higher. This ejected material had to be handled and recovered. The sintering plant through negative action improved the economic phase. Sintering plants call for capital expenditure, and continued costs of operation.

The facts in the case are that the cone and hopper with smaller furnaces performed not only as an excellent gas seal, but as a toler-



o o o

THE by-product coke oven is not a perfect instrument. By dry quenching the plant could develop considerable power and the blast furnace operator could save heat through the use of the improved coke. Furthermore, coke plants often could use more insulation to a considerable advantage, and the consistent use of dryed and de-dusted coal might result in sizable monetary savings.

o o o

able stock distributor. Today in the case of a large furnace with a properly proportioned stock line it functions as a gas seal only, and its continued use in the present form as a distributor is no longer tolerable. An interesting feature in connection with this statement is that every furnace man recognizes the condition and also knows of modifications which mechanically worked satisfactorily in the earlier furnaces of the Lehigh Valley as exemplified by the Bauman, Durham types and the suggested Witherbee modifications. Nevertheless, the writer knows of no case in which anything is being done to correct a most defective piece of apparatus. In the absence of any other form of charging mechanism the bell will have to be enlarged to the size necessary to restore the relationship previously followed, while a smaller concentric bell, sealing within the larger one will distribute stock within a smaller anulus. The excessive weight of such a bell could be minimized by the use of radially ribbed castings in which plate inserts filled the segmental sections. Bells not made in plant shops would have to be split for transportation. Such a bell will enable the operator to restore the older and preferable distribution at the walls and vastly improve the uniformity of the mixture across the throat section resulting from decreased segregation, in which a less channeled, slower and more uniform gas flow should, by increased time action of the gases, effect decreases in fuel consumption.

Since the lifting effect of gas upon particles in a gas stream is assumed to vary as the square of the velocity of the gases, the effect of the larger bell with reference to dust abatement or flue dust is cumulative, first as a result of the permissible larger throat and second because of decreased gas production following decreased fuel consumption. An outer skirt section between the bell and furnace walls will assist in reducing throat abrasion, and also reduce dust carry-over by preventing the off-going gases from blowing through the entire depth of the falling curtain of ore as it drops from the main bell. Not all dust is composed of iron ore; limestone and coke dust are also carried over, the latter frequently in excess of sintering requirements. These wastes could, of course, be greatly reduced by more careful preparation of the stone at the quarry, care being taken to remove all clay and small particles of stone. The fine coke wastes are largely self imposed, most of which can be removed at the quenching station, a subject which will be given fuller attention under coke wastes. Finally, with the adoption of the venturi top in which gas velocities are further reduced and the gas removed through high outlets of proper disposition and generous dimensions, we shall have the necessary elements contributing to greatly decreased material wastes.

Closely related to these factors are the advantages obtained by charging sized material including ores (which do not readily decrepitate or break down), coke and stone. The comparatively few isolated cases where this practice has been adopted have reflected its advantages, more particularly with reference to reduced fuel consumption or coke waste, occasioned no doubt by the more uniform gas solid contact resulting from this practice. In the redesign of furnace made necessary by the modifications indicated, it would be desirable to give consideration to the mobility of the furnace charging aparatus above the floor of the furnace top without dismembering it. The plan followed at the Ensley furnaces greatly reduced the time and effort required in changing bells. Other methods will be suggested by a further study of the subject. Because of the largely increased investment temporarily rendered idle, time waste in bell changes is a factor of importance.

Blast-Furnace Hearth

Modifications of the upper section of the blast furnace have received much attention, and the hearth has been greatly expanded in diameter, but the writer is not aware of any attempt to greatly increase its depth. The hearth serves other important functions than that of a mere receiver permitting the separation of iron and slag. Repeated oxidation and reduction of a very intensive character on the part of the alkali metals existing in the gaseous state below the tuyere level and above the slag line probably play an important role in transferring oxygen carried down by the superheated liquids on their way to the liquid pool. A deeper hearth af-

fording a greater time period covering these reactions may conceivably result in a further oxygen transfer from the slightly oxidized materials on their way down. Since sulphur removal and its final reactions are also not definitely known it is equally conceivable that further desulphurization might result by affording the slag an increased reaction period while trickling down a longer path.

It is probable that the loss of sensible heat of molten iron could be reduced by the insulation of the hot metal mixer, where the insulating material could be readily applied.

In addition to the utilization of slag, as a cement base, concrete aggregate and mineral wool, experiments at the Alabama Polytechnic Institute at Auburn, Ala., indicate the possibilities of its use in the manufacture of glass. Furthermore, in German experiments in which finely ground limey slags were used it was found "that slag not only effects the same increase in some soils but often surpasses the effect of limestone manure. Like limestone the slag acts as an efficient neutralization agent in combating the turning sour of the soil, although its effects take a somewhat slower course. The slag is particularly suited for improving the physical properties of the lighter soils. The specific effect of the slag depends on its high content of highly assimilable silica which increases the resistance of plants to attacks by parasites."

In many instances blast furnaces are located in or near centers of dense population. The demand for concrete aggregate or track ballast in such areas requires very large tonnages. A much greater percentage of these requirements could be derived from blast furnace slag, by maintaining a suitable magnesia content in the slag, and pouring it on in a manner promoting greater density of the solidified slag. Pits suitably arranged for such purposes offer additional advantages, because of decreased costs of track extensions and maintenance.

The continued operation of many stoves now in use results in several forms of waste readily preventable. Due to the availability of washed gas, improvement in checker design, insulation and automatically controlled regulation of combustion it is possible to increase existing efficiencies of 50 and 60 per cent to 88 and 90 per cent, accompanied by the development of much higher blast temperatures. It is probable that even higher temperatures than those now regarded as top figures will be available by the development of more suitable top checker refractories capable of resisting the attack of the fine dry dust composed of alkaline salts accumulating on and softening the top course. In so far as these objectives are realized additional surplus gas will be available for other than stove use and higher blast temperatures will increase hearth heat potential. Following in the train of which will be found reductions in fuel and flux requirements, decreased sulphur and phosphorous in the pig iron, lower blast volume, which by decreasing off-going gas velocities will further decrease flue dust losses. Higher stove temperatures would permit the use of more basic slags, which while tending to increase fuel consumption, would also greatly increase the total potash volatilized as carbonates from the charge thus making more attractive the recovery of potash as a blast furnace by-product.

Use of Dry Blast

In the case of the easily visualized materials entering the blast furnace an effort is made to maintain uniform composition of the ore, coke and stone. In the case of air which constitutes by far the greatest tonnage charged, variations in moisture content ranging from 10 per cent to 100 per cent are not unusual. A furnace producing 600 tons of iron daily with a blast consumption of 40,000 cu. ft. at 32 deg. F. and 14 lb. absolute requires about 2400 tons of air daily. For each grain of moisture content per cu. ft. the furnace hearth would receive about 40 gal. of water each 24 hr. While it is true that the water vapor enters at stove temperature, the breaking down of the water $H_2O + C = 2H + CO$ absorbs 28,900 gram calories. The hydrogen and oxygen again reunite in another and cooler part of the furnace returning the same amount of heat, but unfortunately this does not compensate for the heat removed from the smelting zone where it is most needed. By limiting these variations within narrow ranges of great uniformity, Gayley in his classic demonstration at Isabella eliminated 69 lb. of water per ton of iron produced or 23,192 lb. for 24 hr. Pig iron production increased about 25 per cent, flue dust decreased from 5 to 1 per cent. Fuel dropped from 2147 lb. to 1726 lb., a saving of 421 lb. of coke per ton of iron.

The fuel reduction was in excess of the theoretical saving which could be expected from moisture elimination; this was accounted for by the development of heat at the tuyeres where heat was needed, in an amount estimated at 23 per cent of all the heat required to smelt the iron and slag. The extra heat represented only 3 per cent of the total energy of coke charged, yet it represented 23 per cent of the heat available at the tuyeres, since only 20 to 30 per cent of the fuel in any case is available for smelting at the tuyere region. Because of the margin of safety thus secured the burden ratio could be reduced to a constant factor, which not only resulted in a lowered fuel consumption with decreased sulphur content in the iron, but also a much smoother working furnace, since the incipient development of scaffolds and their continuous sloughing was prevented by the stabilization of the zone of fusion. The increased thermal efficiency of the furnace was reflected in a decrease of 10 per cent of CO and an increase of 23 per cent in CO_2 content of the top gases. Almost concurrently with this development came also that of the gas engine for driving blowing engines and generators. Because of fuel saving possibilities in this direction, the blast furnace has been run as a gas producer, rather than strictly as a heat engine for reduction purposes only. In this shift in practice the furnace manager was deprived of the use of a tool which gave that precision of furnace operation resulting in a superior product of great uniformity, permitting the development of practices in subsequent metallurgical operations which would be of inestimable value.

Oxygen Enriched Blast

Much discussion has followed the suggested use of an oxygen, or an oxygen-enriched blast. The addition of 4 to 5 points of oxygen above the normal content would again greatly increase heat potential in the hearth, resulting

in decreased fuel consumption, decreased blast and stove requirements. While the cost of a gaseous oxygen has been steadily decreasing, the current cost of production remains prohibitive. It is possible that occasional and limited use as a "tonic" may be of great assistance in preventing an impending case of furnace dyspepsia from developing into one of acute indigestion. The regular use of an enriched blast would result in an increase of carbon dioxide and a decrease of carbon monoxide in the top gases, seriously affecting the heat value of this very important fuel, which in terms of coal equivalent, depending upon the furnace, may range from 250 tons to 450 tons of coal per day. For this and other reasons it would seem that the place for the greatest economic advantages following the use of an enriched blast would be the Bessemer converter and not the blast furnace.

o o o

THIS mill is rolling continuous steel strip from molten metal. The problem is of such vast economical importance that it seems worth rating as a major project of intensive research. Its complete solution would greatly reduce the production costs of light plates, skelp, sheets and strip, which of themselves represent a very important percentage of total rolled products.

o o o

Coke Oven Wastes

An outstanding coke oven waste is that of the sensible heat of the coke, uselessly dissipated in water quenching. By the use of dry quenching methods it is possible in practice to generate about 1000 lb. of steam per net ton of coke cooled. With an output of 1000 tons of coke per day there would be sufficient steam if continuously generated to produce about 3400 kw. per hr., assuming a condensing turbine consumption of 12 lb. per kw. That energy is now mostly used in producing free steam and dust which effectively pollute the atmosphere and corrode plant structures. In dry quenching the coke being free of water shock is stronger, producing less fracturing of coke and reducing the breeze production. The latter recovered in the dry state has a thermal value about 16 per cent greater than the usual wet breeze.

The Witkowitzer plant using dry quenched coke showed a furnace fuel reduction of over 3 per cent, while that at Homécourt showed slightly over 4 per cent. Reduced fuel consumption carries with it the probability of further sulphur reduction in the pig iron as well as flux savings. Screening of the coke is effected in the dry state affording more complete removal of coke dust and breeze, which is later reflected in decreased flue dust losses at the furnace, while the recovered breeze is effectively used as fuel. The use of dry quenched coke affords more accurate production or yield records at the coke plant, permits uniform (weight) charges of carbon at the furnace, and, because of its freedom from moisture, requires less water for the condensation of steam at the gas washers. These are factors affecting greater precision of operations, and decreased water requirements, the latter being a form of water waste prevention.

In the South most coking coals are so dirty that beneficiation is necessary before coking. In the northern fields this requirement is not so rigidly mandatory. Appreciating the fuel and flux wastes incident to the use of unprepared coal, there has been an increased tendency to wash those coals which were previously coked in the raw state. The results derived from washing coal for coking purposes, as stated by H. W. Seyles (*Chemical and Metallurgical Engineer*, 1933, p. 470) are:

(1) Ash and sulphur reduction in the coke produced.

(2) A 10 to 15 per cent improvement in physical qualities as determined by tumbler tests.

(3) Decreased yield of small sizes of coke with a corresponding increase of metallurgical coke.

(4) A 20 per cent reduction of hydrogen sulphide in coke oven gas.

(5) Increased yields of by-products comparable with the increased percentage of volatile matter in the coal.

(CONTINUED ON PAGE 60)

A REVIEW of ALUMINUM ALLOYS

First Part

By M. G. CORSON

Consulting Metallurgist, New York

IN this the first of a two-section article, the author introduces his review of all known aluminum alloys. All together, the alloys are grouped into 27 classifications, covering all analyses used here and abroad. This first section of the article covers 12 of these alloys, including binary alloys such as the more common aluminum-zinc, aluminum-copper, aluminum-magnesium, aluminum-manganese and aluminum-silicon alloys, all of which are plain or non-heat-treated. Next week the author will describe the 15 other alloy classifications, and, in conclusion, will point out that only 8 foundry and wrought alloys are really required.

TO properly present the metallurgical situation in the field of aluminum alloys, it is advisable first to give a brief picture of the general requirements which any alloy must satisfy if it is to prove of high value, and, second, to give the fundamental structural features that form a prerequisite for meeting such requirements.

The most important characteristics required to make an alloy highly useful are:

A considerably higher strength than possessed by the basic metal.

A high elasticity limit and a yield point sufficiently distant from the ultimate tensile strength.

A considerable ductility so as to insure good workability of the alloy during pressing and drawing—at least within a certain conveniently maintainable range of temperatures.

A good resistance to corrosion, especially to atmospheric, fresh water and sea water corrosion.

A number of other conditions might be mentioned, but they all are of a secondary nature and must be considered in specific cases only.

All these requirements can be expected to be met in one structural case only, namely: *The alloy composition should be of a type that represents a nearly uniform solid solution of the added elements in the basic one, at least within some range of temperature.*

This rule is of a most universal nature. It applies to all steels, all high-strength bronzes and brasses, etc. True enough, there are exceptions and these are sometimes of great industrial importance. However, the fact that such exceptional compositions never represent an approximation to a solid solution plays a strictly negative part. These exceptional alloys are accepted not because they are incapable of ever forming solid solutions but in spite of this fact.

Cast iron, both gray and chilled, is one such instance of an alloy that never does form a solid solution. For this reason it possesses a comparatively low strength and no ductility whatsoever. It is used merely because it is so easy to make and so very, very inexpensive.

Another instance of an exception from the rule may be presented in the case of copper-high lead and copper-tin high-lead alloys. These two can never form even an approximation to a solid solution. Consequently, their tensile strength is lower than that of copper, their elastic limit ex-

tremely low and their ductility most inferior. And, due to these negative characteristics, copper-lead alloys are used in only a few particular applications. In certain types of bearings their high plasticity (due to the high lead content) is so highly useful that the low strength and low ductility inherent in them must be left out of consideration.

With this first rule of structural fitness expounded, one more question might be asked: Shall the alloy represent a permanent solid solution or shall it be capable of a decomposition in two or more constituents? Unfortunately, no one-way answer is possible.

From the view of easy manufacturing the first situation is the most desirable. To make a hard product by mere cold working and to soften it by a none-too-careful anneal represents the ultimate of low cost. However, the hardness and strength so obtainable are limited, while other characteristics, particularly conductivity for heat and electricity, are quite low both in the cold-worked and the soft-annealed state.

The capacity to change from a solid solution to a mixture of two or three phases, one or more of these being dispersed through the matrix of the major phase (composed mostly of the basic metal) is of great value in a number of cases. It permits the obtaining of strengths and especially hardnesses and elastic limits considerably above the values obtainable by cold work alone, and it allows of raising considerably the alloy's specific electrical and thermal conductivities. On the other hand, it requires careful work, special apparatus and most certainly entails a loss in time. Hence the average manufacturer prefers not to use such alloys, unless their use is absolutely necessary.

Coming now to the subject of aluminum alloys, it is necessary to face the question as to how prolific aluminum may be in its capacity to form solid solutions, and, further, which of them are of the permanent and which of the alterable type.

And at this point the first disappointment is met. Aluminum

THE first clamshell dredge to utilize aluminum in boom construction. The outer 150 ft. of this 240-ft. boom is built of strong aluminum alloy structural shapes and plates which permitted the operator, Sternberg Dredging Co., to use a dipper of 50 per cent larger capacity than would have been possible with a conventional boom of the same length. Aluminum Co. of America photo.

does not form so many solid solutions as iron, nickel, copper, gold and even silver are able to form. Aluminum is somewhat more versatile in this direction than magnesium, considerably more so than zinc, but still this versatility of aluminum is rather limited.

There are only a few elements which are taken into solid solution by aluminum to any larger extent. For copper, magnesium, zinc and lithium the solubilities at high and low temperatures have been established with a great deal of precision.

Then again, consider manganese, chromium and silicon for which the solubilities are small and none too precisely established. This statement is made in view of the fact that the ranges of solubility were determined for these series by one method only (microexamination of sections) and they should be corroborated by other, well accessible means.

And further again, consider silver and tin, both of which are definitely soluble in solid aluminum but are incapable of producing strong alloys, and, furthermore, are decidedly deleterious to corrosion resistance.

Apart from the elements just mentioned, no others form solid solutions in aluminum beyond 0.05 per cent, though the present author would persist in his suspicion that a larger extent of solubility must exist for nickel.

From the solubility data presented in the accompanying table, it is evident that, with the exception of magnesium and zinc, all other elements just mentioned are soluble in aluminum to a rather moderate degree. If the solubility were to be considered in terms of dissolved atoms per 100 atoms of solution the solubility figures would have become considerably smaller. Copper which has a maximum solubility of near 6 per cent by weight is actually soluble to 2.7 atomic per cent only. In comparison to it, the maximum solubility of beryllium in copper (2.7 per cent by weight) amounts to fully 16 atomic per cent. It would be quite logical, therefore, if the alloyed atoms, when fully dispersed among aluminum atoms in the latter's grains, were to produce a comparatively slight improvement of its mechanical characteristics.

And this is actually the case. As far as binary aluminum alloys can be kept in the state of perfect solid solutions, the effect remains comparatively small.

Zinc, being the second most soluble element, whether by weight or atomic percentage, naturally exerts the largest hardening influence even while in the fully dispersed state. Also, because it can be kept in solid solution without much difficulty (by quenching or even by air cooling from the proper temperature) it does not too strongly affect the ductility of aluminum. In short, alloys of aluminum with zinc with not over 12 per cent of the latter (by weight) form the strongest and most ductile alloys on the basis of a nearly permanent solid solution.

There are other reasons why aluminum-zinc alloys might have represented one of the most important structural materials in the field of aluminum alloys. They are most easy to obtain in a sound, that is, a sufficiently gas-free state. They take a good polish. They are most easy to make by merely dissolving melting zinc in molten aluminum.

Aluminum-Zinc Alloys

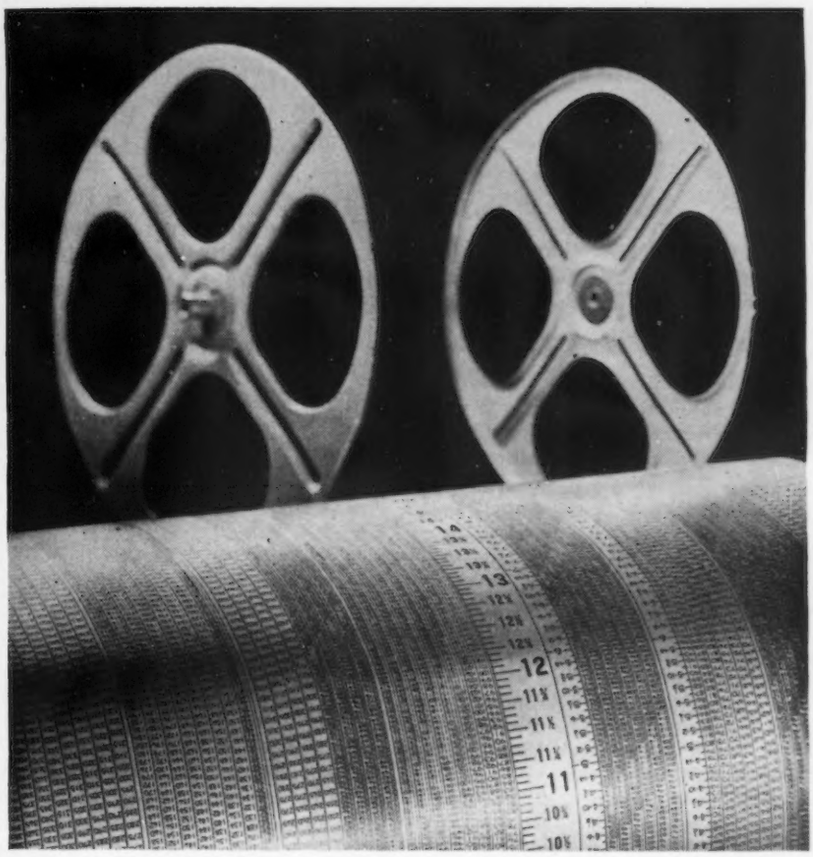
These were the reasons why on the continent of Europe, aluminum-zinc alloys—mostly containing not over 10 per cent zinc (8 per cent was the standard in Germany)—were widely used and probably are still used to a small extent, with the exception of France. However, a number of material defects accompanied the advantages mentioned. As a rule, aluminum does not exert a strong corrosion protective action upon elements alloyed to it. For this reason alloys containing so large amounts of zinc are not immune even to tap water, to say nothing about sea-water spray. Furthermore, aluminum-zinc alloys have their atoms mobile to such an extent that cold-worked articles are apt to self anneal at room temperatures; heating to 60 deg. C. robs them to a large extent of the strength and hardness induced by cold work. French manufacturers found out these defects of aluminum-zinc alloys at quite an expense after small coins of this alloy used in the colonies deteriorated thoroughly.

In the light of the result just mentioned, aluminum-zinc alloys must be considered to have little importance in the field of industrial metallic materials. However, they can and should be used for castings wherever conditions of service permit. These alloys will

ON the right is an aluminum alloy piston with an abrasion-resisting surface formed by the Alumilite process. This type of piston was adopted by many leading automobile manufacturers for 1936 models. On the left is an untreated aluminum alloy piston.

be designated as No. 1 in the list of alloys to be considered in this article. They deserve this position at least from the historical viewpoint.

There is a belief that the second historically used alloy of aluminum was a binary aluminum-nickel alloy carrying 6 per cent of the latter and used mainly for castings. Perhaps this belief corresponds to historical facts, although authentic data regarding the use of such alloys and their characteristics are sadly lacking. But, be it as it may, such alloys were quite early replaced by aluminum-copper alloys — one of which, with 8 per cent copper, remained the standard aluminum foundry composition for many years and is known as alloy No. 12 in the United States and as the "American" alloy in Europe. In this article, it will be listed as alloy No. 2.



IN the Toledo Plaskon scale, some 15 lb. of aluminum parts in the form of sand castings, die castings and sheet help keep the weight of the scale at a minimum. The price chart, made from a sheet of aluminum, contains over 95,000 figures. Since it will not wrinkle or swell, the price indicator can be placed close to the chart, thereby eliminating inaccuracies caused by parallax. Aluminum Co. of America photo.

This aluminum-copper alloy is a striking example for the rule that no particular improvement may come from the use of alloys which are not and could not represent solid solutions. While they contain only about 2 per cent more copper they *may* go into solid solution, and while they may not contain more than 5 per cent by weight or 3½ per cent by volume of the hard and brittle compound Al_2Cu, their characteristics are very much lower than might be expected. It should be quite warranted to look for some 30,000 lb. per sq. in. ultimate strength and an elongation of 10, perhaps 20 per cent. Instead of this, it is rarely possible to get 21,000 lb. per sq. in. strength and not over 2 per cent elongation. The cast alloy contains far too much of the compound Al_2Cu along the boundaries of its grains (as cast) to possess any substantial amount of ductility. In addition, it rarely, if ever, is quite sound because of gas inclusions. Nevertheless, it was and still is one of the most common alloys in the aluminum foundry.

Doubtless there must be reasons why this 8 per cent Cu-Al alloy is used in preference to alloys lower or higher in copper. Perhaps alloys of the first type might be too soft and deformable, but this subject has not yet been thoroughly investigated.

Higher copper aluminum alloys are also used, namely, those with 10 and 14 per cent copper. These two analyses will be designated as alloys Nos. 3 and 4 herein. They may carry fancy names—like "piston alloy", etc., but this does not mean at all that one or another is particularly suitable for pistons or the like. Comparative tests were evidently never made or at least never reported.

Lower alloys (as to copper content) were used to an extent in the rolled state. Made carelessly they do not represent a solid solution, but a nondescript mixture of a solid solution with precipitated grainlets of the aluminum-copper compound in various states of dispersion. And while alloys with 4 per cent copper, kept in solid solution by quenching previous to hard rolling, are capable of being quite strong and hard and at the same time sufficiently resistant to corrosion, the carelessly made product is not at all corrosion resistant. Hence binar aluminum-copper alloys are practically unknown to the trade in the wrought state.

Aluminum-Magnesium Alloys

Binary aluminum-magnesium alloys had a very strange history. "Deoxidation" being the alpha and omega of the foundryman's desiderata, no matter what metal or alloy he intends to use, great hopes were placed upon the potent deoxidizing power of magnesium metal. For this reason it was used frequently in small quantities at a time when little if anything was known regarding aluminum-magnesium alloys. It did not live up to the expectations. No other aluminum base alloy managed to possess such a chalky dull coloring at its fractures as magnesium-treated aluminum did.

Higher amounts of magnesium seem to have met with some success, commercial more than technical. Some 30 years ago an alloy called "magnalium" was advertised as a kind of a miracle metal in Europe. It was offered specifically for parts of scientific in-

struments used in hot and damp climates. Scientific expeditions specified "magnalium cameras" for their photographic equipment. However, this fad proved to be quite ephemeral. The author makes bold to state that the old "magnalium" probably had no magnesium in it at all. Otherwise, it hardly might have happened that during that considerable period of time that elapsed between the use of the old magnalium and the new aluminum-magnesium alloys actually containing from 6 to 10 per cent magnesium, very little was being heard of them.

These new aluminum-magnesium alloys evidently require a specific method for compounding. Once in the form of ingots, they seem to be easily tackled with the regular foundry equipment. They can be used both as-cast or in the wrought state and certainly form the strongest aluminum alloys producible without any specific heat-treatment. Their corrosion resistance is also quite high. The two alloys containing from 6 to 10 per cent magnesium will be designated herein as Nos. 5 and 6.

Aluminum-Manganese Alloys

Binary aluminum-manganese alloys constitute a class having considerable practical use, though of very limited composition range. Not over 2 per cent manganese is added to aluminum for castings and just about 1.2 per cent in the making of wrought products. The first one possesses in the sand-cast state practically the same mechanical characteristics as the Al-Cu alloy No. 12 (author's No. 2). The 2 per cent and 1.2 per cent Al-Mn will be designated herein as alloys Nos. 7 and 8.

Years ago, manganese was thought of being nearly insoluble in solid aluminum and of crystallizing as a secondary constituent of the formula Al_3Mn. This made the situation rather strange, for it meant that some 3 per cent of a brittle intermetallic compound located around the grain boundaries could produce a hardening of some 50 per cent and more. In the light of recent investigations which show that manganese is soluble in solid aluminum to the maximum extent of 1.8 per cent, it becomes clear that the considerable hardening effect inherently present in aluminum-manganese alloys must be due to that solubility and to a number of additional effects based upon it. It is known also by now that the first aluminide of manganese formed has the formula $MnAl_6$.

Aluminum-Silicon Alloys

Silicon is also soluble in aluminum to the extent of nearly 2 per cent. However, little improvement in the characteristics of aluminum is obtainable when silicon is added within that limit of its solid solubility. The reasons for this are not clear. It is necessary to remember that the rule, that an alloy to be of extensive use must have in its history a range in which it forms a nearly perfect solid solution, represents a minimum, not a maximum, prerequisite. It is a necessity, not a sufficiency.

With the increase in silicon content, hardness and strength increase slowly until the maximum strength is reached with about 10 per cent silicon. At the same time ductility decreases continuously. Beyond this limit strength drops as well, though hardness continues to increase. This is quite logical because hardness changes represent a continuous function of the amounts of the constituents present.

Ordinary aluminum-silicon alloys form good materials for the foundry. With due precaution (They must be melted carefully, avoiding gas contaminations. The ingot aluminum should not contain over 0.3 per cent iron), they yield sound, leakproof castings of good wear resistance, and, in regard to corrosion, they are quite superior to all aluminum-copper alloys.

There is quite a gradual change to higher strengths and hardness in the lower range (up to 10 per cent), and, therefore, a definite distinction is impossible. However, two alloys—one with 6 per cent and one with 10 per cent silicon may be considered as representing this class of alloys. These alloys shall be designated as alloys Nos. 9 and 10, while the higher silicon alloys (about 18 per cent) shall be called No. 11.

All aluminum-silicon alloys can be modified so as to possess a higher strength and a much higher ductility, though their yield point and hardness remain unchanged. This is done by treating the molten alloys with small amounts of sodium or sodium fluoride. The change is expressed also in the lowering of the eutectic temperature and an increase in the amount of silicon at the eutectic composition from 10.5 to 13 per cent. The eutectic grainlets of silicon are much smaller in the modified than in the ordinary alloy, the whole structure looking more refined.

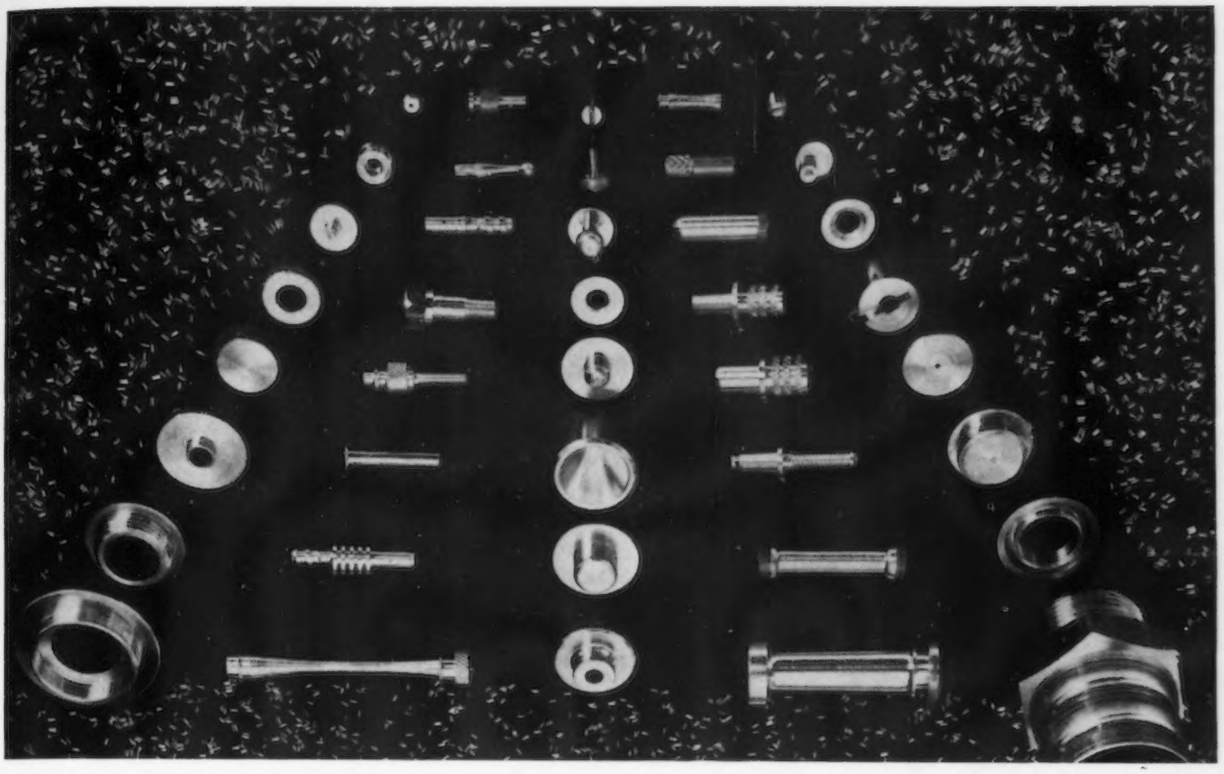
At 13 per cent silicon, the modified alloy may be had with a strength of 30,000 lb. per sq. in. and a ductility of 5 per cent, which is rarely met in aluminum-base

SOLID SOLUBILITY OF DIFFERENT ELEMENTS IN ALUMINUM AND THE FORMULA OF THE NEXT CONSTITUENT

Element	Solubility Near the Melting Point, in Per Cent	Solubility at Room Temperatures in Per Cent	Next Constituent
(I) Group of Considerable Solubility			
Zinc	over 12	about 3	About ZnAl
Copper	5.8	less than 0.5	$CuAl_2$
Magnesium	about 13	less than 0.5	Mg_2Al_3
Lithium	3.5	2.8	Li_2Al_3
Silicon	about 2	less than 0.3	Si
Silver	about 30	less than 0.5	Ag_2Al
Tin	Situation most indefinite		Sn
(II) Group of Slight Solubilities			
Manganese	about 1.8	less than 0.2	$MnAl_6$
Chromium	about 0.3	very slight	$CrAl_7$
Nickel	less than 0.2	very slight	$NiAl_3$
Iron	less than 0.1	very slight	$FeAl_3$
(III) Group of Quite Insoluble Elements			
Antimony	.....	.....	SbAl
Boron	.....	.....	?
Beryllium	.....	.....	Be?
Calcium	.....	.....	$CaAl_3$
Cerium	.....	.....	$CeAl_4$
Molybdenum	.....	.....	MoAl
Titanium	.....	.....	$TiAl_3$
Tungsten	.....	.....	?
Vanadium	.....	.....	VAl_3
Uranium	.....	probably	?

(IV) Quite Insoluble Even in Liquid Aluminum

Bismuth, Cadmium, Carbon, Lead, Phosphorus, Potassium, Selenium, Sodium, Sulphur, Tellurium, Thallium.



ALUMINUM screw-machine products made from a free cutting aluminum alloy developed primarily for use on automatic screw machines.

foundry alloys. This alloy will be called No. 12.

The mechanism of the modifying treatment is still quite obscure. No physical measurement and no X-ray search for the possible change in the internal structure of the grainlets of silicon have resulted so far in providing a key to the phenomenon. But, while it is out of place to discuss here all the possible theories offered, the author wishes to state that in his opinion the action of sodium probably causes an increased amount of atomic dispersion of silicon while the alloy is still liquid, and that this atomically dispersed silicon may be far more soluble in solid aluminum and far less capable of forming large eutectic grainlets than the non-atomically dispersed silicon of the melt.

The modified aluminum-silicon alloy otherwise known as Alpax was enthusiastically received at the time of its discovery, for here was an extremely convenient and inexpensive method of obtaining strong aluminum castings. However, it was found also that the castings are likely to be porous and that this porosity is not easy to control. Hence the present field of uses for Alpax is quite restricted and the non-modified alloy with 10 per cent silicon plays a far more important part.

And so an end is reached in the list of plain (non heat-treated) binary alloys of aluminum that are being used now with some reason. A number of other binary aluminum alloys can be made and used and sometimes even an advantage of a sort may be claimed, which is quite an easy thing. But, whether we manage to add some iron, titanium, vanadium, molybdenum, tungsten, cobalt, tantalum, columbium, zirconium — and this practically completes the list of possibilities—the result will be that the added element will form an aluminide of a more or less complicated nature (mostly more than less). This aluminide may be located within the grains of aluminum (rarely) or at their boundaries (most frequently); in a purely additive way it will always raise somewhat the alloy's hardness and strength while lowering its ductility way out of proportion to the slight hardening obtained.

Due to the softness and plasticity of aluminum it can be hot worked, sometimes even cold worked after these foreign constituents have brought its elongation (in the statical test) to near zero. But in no way do these foreign constituents form an improvement whether in the cast or in the wrought state.

The same is true for alloys in which a number of elements insoluble in solid aluminum are added to the molten metal in small amounts in the hope that each one will exert a distinct and beneficial influence. There was for a time upon the market an aluminum alloy containing, for instance, 1 per cent nickel, 1/3 per cent chromium, 1/3 per cent molybdenum and 1/3 per cent tungsten —all forming aluminides and only the first two slightly soluble in solid aluminum. Lots of advantages were claimed for this alloy, although its mechanical characteristics were not a bit better than those of the regular alloy containing 1.2 per cent manganese. This quinary alloy has been used for a time even in airplane constructions, but was discreetly eliminated in the run of time.

Ed. Note: Next week the author will conclude this discussion of aluminum alloys by describing the heat-hardened binary alloys and the structural characteristics of ternary alloys.

HOW TO WELD TWENTY-NINE METALS

By CHARLES H. JENNINGS
Engineer in Charge of Welding Research, Westinghouse Electric & Manufacturing Co.

THE rapid growth in the use of electric arc welding and the development of modern alloys calls for a highly specialized knowledge of arc welding and its application.

To gain this specialized knowledge, it is essential that a continuous program of research and development be carried on not only with respect to the practical and theoretical aspects of arc welding, but also with respect to the design of arc welded structures with a view of determining the best procedure, conditions and materials for the job.

Ever since arc welding was first developed, Westinghouse has carried on such a program. This has been responsible for many advances in the design of welding equipment and in the practice of arc welding.

In this and following articles in a comprehensive and unusually valuable series, The Iron Age will present the Westinghouse welding experience as applied to 29 metals.

In addition to the text matter and tables in this first installment, attention is called to the nine pages of specific operating data contained on pages 36 to 45 inclusive. These data will be found of great value as criteria for comparing one's practice with best practice and also in estimating time and cost with respect to various forms of welded joints.

THE weldability of metals is dependent upon a great many factors, such as chemical compositions, metallurgical characteristics, physical properties, type of electrode and welding technique employed, treatment prior to welding, and subsequent treatment after welding. Some metals, such as low carbon steels, are relatively easy to arc weld while others, such as brass, are more or less difficult to weld. In every case, however, there is a definite reason for the results obtained and a knowledge of these factors is of the utmost importance both to the welding operator and designer of welded products and structures.

The success obtained when welding any metal is a function of the oxidation of the chemical constituents, the vaporization of some of the alloying elements, the presence of non-metallic inclusions, changes in the metallurgical structure, and the solubility of gases in the deposited metal.

Certain elements in a metal, such as carbon, may combine with oxygen to form a gaseous oxide and cause gas pockets in the weld. Other elements, such as silicon and aluminum will form solid oxides which result in slag inclusions. A third type of element, such as iron, will form solid oxides which are soluble in the molten weld metal and consequently produce welds that are brittle and of low strength.

The presence of some elements in an alloy, such as zinc, have a melting temperature lower than that of the alloy metal. Consequently, they will vaporize as a result of the welding operation and produce a change in the chemical composition of the metal. This

may result in the presence of gas holes in the deposited metal.

Some metals contain finely divided oxides which have a melting point higher than that of the parent metal. These oxides do not coalesce as a result of the refining operation on the metal. The extremely high temperatures obtained in the arc welding operation often causes these finely divided inclusions to coalesce and form inclusions in the fusion zone or in the weld.

All metals undergo structural changes as a result of the arc welding operation. These changes are a function of the chemical composition of the material, the temperature obtained during the welding operation, and the rate of cooling from the molten state. The effect of these changes on the resultant joint depends upon the alloy welded. In some cases they may produce hardness and brittleness in the weld and areas adjacent to the weld, while in other cases they may seriously affect the corrosion-resisting properties.

The solubility of gases in metal may affect the properties of a welded joint in three ways. Some elements will hold more gas in solution at high temperatures than at low temperatures. Upon cooling, therefore, they will dispel some of the gas dissolved at high temperatures and produce porosity in the weld metal. Secondly, the burning out of one or more elements during the welding operation may reduce the ability of the metal to dissolve gases and as a result cause some gas to be given up and produce porosity. The third effect obtained by gases dissolving in the metal is the formation of stable compounds between gases and one or more of the elements such as iron nitride, which seriously affect the physical properties of the weld.

The use of the proper welding electrode and welding procedure will, in general, eliminate or reduce to the minimum the effect of the foregoing items, thereby producing more satisfactory welded joints.

Weldability of Steels

The fusion welding process involves the deposition of molten metal between the parts to be joined and the melting of a small portion of the base metal both of which are cooled rapidly by reason of the absorption of heat by the large mass of colder base metal. As a result, certain metallurgical changes are encountered. The degree of these metallurgical changes may be influenced by the preheating of the base metals, the thermal capacity of the parts, and the deposition of multiple beads.

In general, the weldability of steels can be judged from the metallurgical changes resulting from welding. Austenitic steels are characterized by great ductility and toughness, martensitic and troostitic steels by hardness and brittleness, and sorbitic and pearlitic steels by a desirable combination of strength, ductility, and toughness. The austenitic steels are, therefore, generally considered to be readily weldable since they are not subject to carbon constituent changes and their toughness permits resistance to welding stresses without fracture. Steels which remain pearlitic or sorbitic in the heat affected zone, i.e., steels which do not weld harden, may be readily welded. Steels which become martensitic in the heat affected zone are welded only with difficulty because their hardness does not permit deformation without fracture under welding stresses. Such steels require preheating to prevent cracks and annealing immediately after welding to transform the hard martensitic constituent to more ductile sorbite or pearlite.

Theoretically, it should be possible to arc weld any martensitic steel that can be cast or hot worked providing the proper preheating is employed and a corrective heat treatment is subsequently applied. In practice, however, this procedure is impossible for many reasons.

Carbon is one of the most important elements from the standpoint of the weldability of steels. Carbon is a hardener and in percentages as low as 0.30 per cent, producing a noticeable effect on weldability. The presence of other alloying elements such as chromium, nickel, molybdenum, etc., tend to intensify the hardening effect of carbon. Consequently, when such elements are present it is desirable to have the carbon content low. As a general rule, the lower the carbon content of an alloy steel, the better its welding characteristics.

Structural grade steels having a carbon content below .25 per cent are generally considered to be low carbon steels. These steels are, in general, easily welded and the resultant welds are of extremely high quality. The chemical analysis of steel of this grade may range as shown in Table I.

TABLE I

Chemical Analysis of Low Carbon Steel SAE 1015

Carbon	0.10-0.20 per cent
Managnese	0.35-0.60 per cent
Silicon	0.02-0.06 per cent
Phosphorus	0.05 per cent max.
Sulphur	0.05 per cent max.

Many types of electrodes may be

THE AUTHOR

CHARLES H. JENNINGS, engineer in charge of welding research for the Westinghouse Electric & Manufacturing Co., has long been intimately identified with arc welding research and development. In his work he has conducted exhaustive investigations into the joining of metals by the electric arc both from the theoretical and practical points of view.

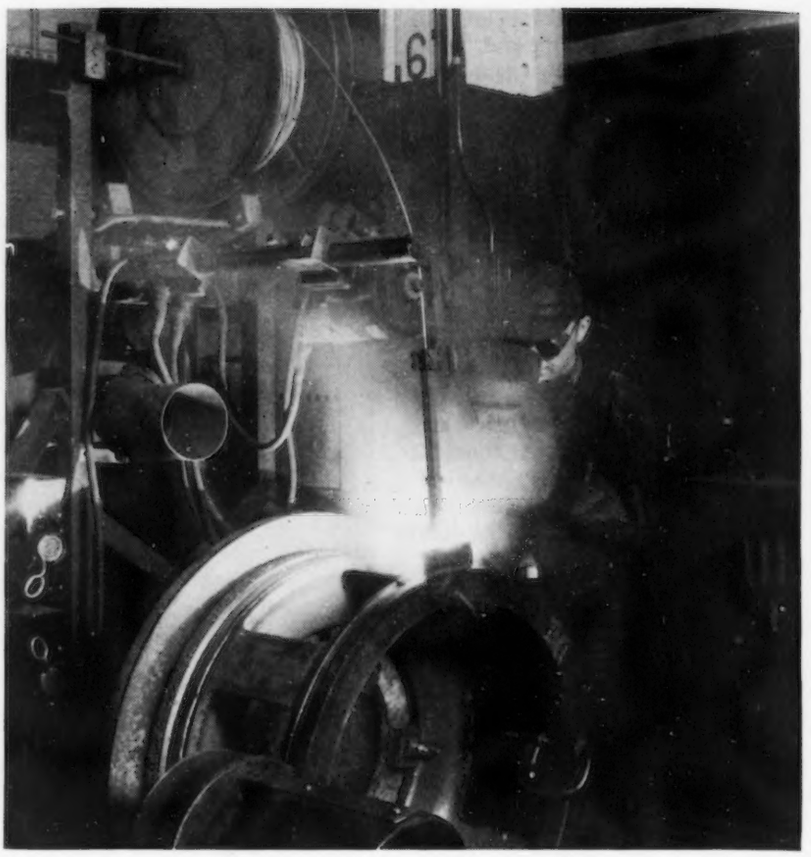
In addition to his duties as engineer in charge of welding research, he supervises all electric welding in the many Westinghouse factories. In this capacity he served as consulting engineer on welding in the design of the Boulder Dam gates, and specified the entire welding procedure.

With this rich background of practical and theoretical experience, Mr. Jennings was eminently qualified to prepare this series "How to Weld 29 Metals." The information it contains will iron out many difficulties that have troubled operators in the welding of our modern alloyed metals.

used to weld steel of this class such as bare, dust-coated, washed or dipped, and shielded-arc or flux-coated electrodes. The results obtained are highly satisfactory, depending upon the type of electrode used. Carbon arc welding is also practised on these steels, the results obtained being a function of the technique employed.

When welding low carbon steels, preheating is not necessary unless the parts are extremely large, and subsequent annealing is not required unless it is desired to eliminate the residual stresses set up during the welding operation. The preheating of heavy parts is resorted to primarily because the toughness of steel is greatly increased when it is hot, and consequently the danger of cracking is reduced.

The technique of striking the arc, fusion, and crater formation are essentially the same for all metallic welding processes. Consequently, they will be considered only in connection with the welding of low carbon steel.



DEPOSITING phosphor bronze on a steel part by automatic welding. Base, 10 per cent tin phosphor bronze electrodes are used for this application.

Striking the Arc

When welding with the metallic electrode, the arc is drawn by touching the work with the welding electrode and immediately withdrawing it again. In striking the arc, a very deliberate movement is required in which the electrode is withdrawn immediately after touching or scratching the work. A straight up and down movement can be used to strike the arc, but this movement might give truoble to the beginner by the electrode sticking to the work. A better method is a scratching or side movement of the electrode. This method will minimize the tendency of the electrode to "freeze" to the work.

After the arc is established, it is necessary to move the rod downward at a uniformly continuous rate to compensate for the part that is melted away. If this is not done, the arc gap becomes too great to permit good welding.

After the arc is established and fusion of the work is obtained, the electrode is moved along the line of welding with just enough speed to secure fusion of the work and to allow the deposited metal to complete the weld. It is necessary to advance along the line of weld at a uniform rate of speed to insure a smooth uniform weld deposit.

When the arc is broken, either accidentally or to change electrodes, special care should be taken in restriking it. The arc should be struck at the forward end of the crater, moved backward across the crater, and then forward again and the welding continued. This procedure insures good fusion and aids in eliminating porosity and entrapped slag.

Fusion

Fusion of the work or base metal is indicated by the appearance of the metal at the arc terminal. In order to obtain fusion between the deposited metal and the base metal it is essential that the base metal be melted. The experienced operator can tell when fusion is being obtained because the walls of the crater will become liquid and the deposited metal will tend to flow and unite with the liquid base metal. If the base metal is not melted, the deposited metal will tend to roll away from it in much the same manner as mercury does from glass.

Withdrawal of the welding electrode from the molten pool results in immediate cooling of the molten metal. This cooling is accompanied by considerable shrinking and the formation of a crater. The shape of this crater is largely dependent upon the type of electrode used, the polarity of the welding circuit, and the manner in which the arc is broken.

Straight polarity (electrode negative) tends to form a deeper crater than reverse polarity under the same conditions. If the arc is broken suddenly with a bare electrode when using straight polarity, a deep crater is usually formed. The depth of the crater can be used as a good reliable guide to the depth of penetration (the depth to which the base metal is melted). When welding with a flux-coated or shielded-arc electrode, a deep crater may or may not be formed depending upon the electrode used and the heating of the weld. If the arc is drawn out slowly, the crater may be entirely filled. As a result, penetration cannot be determined from the depth of the crater in such cases.

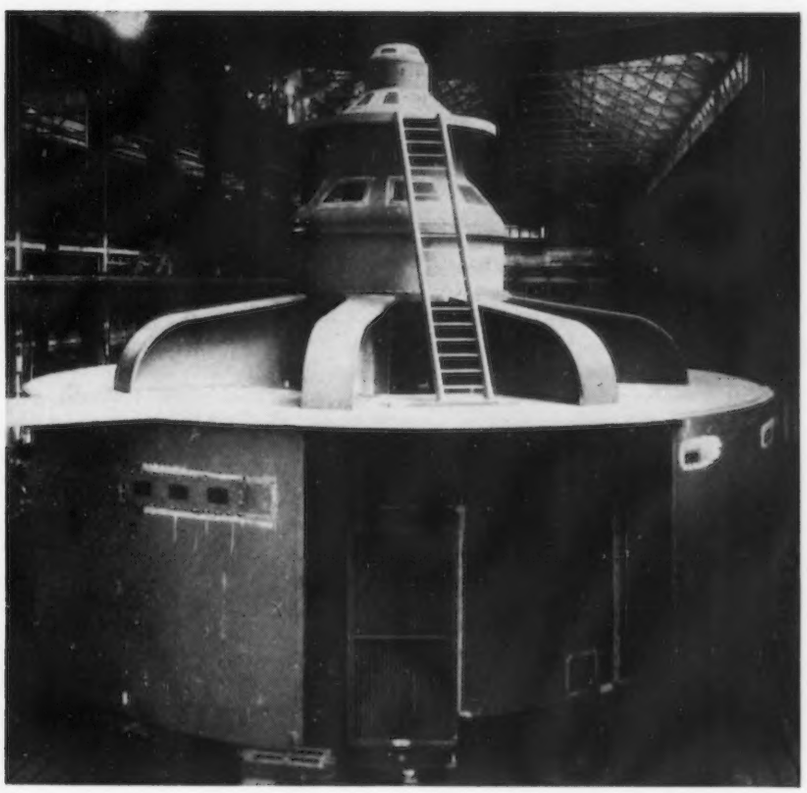
When welding with any type of electrode, it is essential that the arc be played upon a given spot until fusion occurs. It can then be moved in any direction desired, but not too rapidly, as the heat of the arc must have time to melt the base metal as the arc advances.

In welding operations it is often desirable to widen the area of fusion beyond that which can be obtained by a straight line advance. This is done by weaving. Weaving takes many forms and is dependent upon the type of electrode used. Regardless of the weaving motion used, however, it is essential that it be uniform in order to prevent points of poor fusion and entrapped slag or oxides.

Arc Length

The proper length of arc to hold when welding will depend upon the type of electrode used and the position of welding. Welding in the vertical and overhead positions usually require the holding of a shorter arc than is the case when welding down hand. The recommended arc length for welding with bare or washed electrodes is from ⅛ to 3/16 of an inch. This corresponds to an arc voltage of about 14 to 22 volts. When welding with coated or shielded-arc electrodes, the arc length is generally greater and corresponds to an arc voltage of 30 to 40 volts. The arc voltage for a given length arc will vary for coated electrodes because of the influence of the ionization produced by the electrode coating. When welding in the vertical or overhead positions with coated electrodes, a short arc, corresponding to a voltage of 20 to 25 volts, should be maintained.

It is generally considered good practice to hold a short arc when welding with a metallic electrode. A long arc increases oxidation of the deposited weld metal, fosters poor fusion, increases spatter, and tends to produce rough irregular weld deposits. When welding with coated electrodes, a certain amount of puddling of the molten pool is obtained from the drive of the arc. A long arc tends to reduce the puddling action and may result in porosity and inclusions. Also, a long arc makes it more difficult to control the molten slag obtained from a coated electrode.



ASSEMBLED view of an 82,500 kva. generator for Boulder Dam. The upper and lower brackets, frame and housing are of arc-welded construction. The total weight of the generator is slightly over 2,000,000 lb.

The proper welding current to use with a given diameter electrode depends upon the type of electrode, the mass of the material being welded, and the position of welding. As a result it is only possible to give a current range for different electrodes. Current values, both higher and lower than those given, can be used in special cases.

Welding Current

The recommended current ranges for different types and sizes of electrodes are given in Table II. Electrodes containing mineral type coating and so-called high-speed electrodes generally operate on higher current values than electrodes containing coatings of the gas-producing type. As a result, such electrodes should be used at welding currents near the upper limit of the range given. Electrodes having coatings of the gas-producing type should use current values closer to the mean of the current range given. Also, when making vertical welds from the top down, the current values used should be from 10 to 20 per cent higher than the current values used when welding from the bottom up.

Carbon Arc Welding

Carbon arc welding is considerably different from metallic arc welding in that the arc is drawn between the base metal and a carbon or graphite electrode. The arc heat in this case is used only to melt or fuse the base metal and the addition of filler metal when required must be obtained by a specially prepared flange or upset edge on the joint or by some extraneous method. The latter method of adding filler metal can be accomplished by placing additional metal on the seam to be welded or by feeding it into the weld in a manner similar to that employed by the oxy-acetylene process. In carbon arc welding, straight polarity is always used.

The method of striking the arc for carbon arc welding is similar to that outlined for metallic arc welding. The arc voltage and welding currents used are considerably different, however. Too short an arc will tend to deposit excessive amounts of carbon on the base and weld metal, while too long an arc tends to produce excessive oxidation.

Recommended current values

TABLE II

Recommended Current (Ampere) Ranges for Metallic Arc Electrodes

Electrode Diam. (Inches)	Bare, Dust-Covered and Washed Electrodes: Horizontal Welding	Bare, Dust-Covered and Washed Electrodes: Vertical and Overhead Welding	Coated or Shielded-Arc Electrodes: Horizontal Welding	Coated or Shielded-Arc Electrodes: Vertical and Overhead Welding
1/16	20–50	.....	25–70	.....
5/32	50–85	.....	60–100	.....
1/8	75–125	60–120	80–150	75–130
5/32	110–185	100–150	125–225	115–160
7/32	150–220	120–170	140–240	125–180
1/4	200–300	.....	200–350	170–220
5/16	.....	.....	250–500	.....
3/8	.....	.....	325–650	.....

and arc lengths for different diameters of graphite electrodes are given in Table III.

TABLE III

Current Values and Arc Lengths for Graphite Electrodes

Electrode Diam. in Inches	Current in Amperes	Arc Length in Inches
1/4	75–125	1/16
5/16	125–200	1/16
3/8	150–250	1/16
5/8	250–350	1/2
3/4	375–450	5/8
7/8	500–700	1/8–3/4
1	800–1000	7/8–1

Most carbon arc welding is done without the presence of a shielding atmosphere and the resultant welds are brittle. During recent years, however, methods of shielding the arc by painting the weld with a special flux and by introducing a suitable fluxing material into the arc have been developed. The results obtained from such methods of arc shielding are quite varied, but in many cases high quality welds have been obtained.

Welding Procedures and Speeds

The recommended welding procedure for welding a given joint will be a function of the joint design, the type of electrode, the position of welding, and the quality of the weld desired. Having a given set of variables, there is a preferred welding procedure to use in order to obtain the most satisfactory results with regard to the soundness and quality of the resultant weld. Such recommended procedures are given in the following tables.

In connection with the development of a given welding procedure there are a number of fundamental factors to be considered.

(1) In order to obtain the highest quality weld it is essential that the procedure be developed so that complete grain refinement of all beads or layers (the last layer excepted) be obtained as a result of the deposition of a subsequent layer or layers. Deposited weld metal that is not refined as a result of the deposition of subsequent layers of weld metal or other methods of heat treatment, has a coarse columnar structure and is inferior to refined weld metal from the standpoint of ductility. In order to obtain complete grain refinement, all beads or layers should be uniform in thickness. The degree of cooling between subsequent layers or beads also has an important influence on the per cent of grain refinement obtained. If the weld is allowed to cool between subsequent layers or beads, there is often danger of obtaining only partial grain refinement as a result of the more rapid cooling effect obtained.

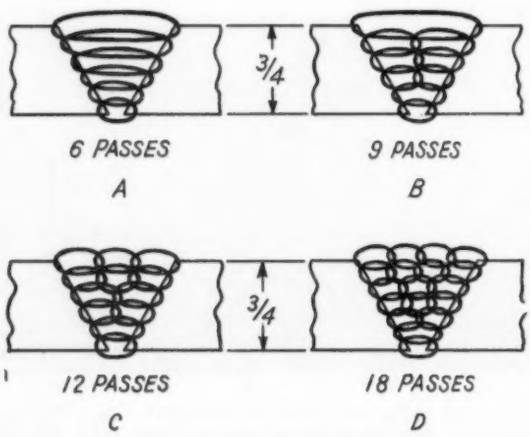
(2) The soundness, tensile strength, and ductility of a weld is a function of the number of passes or layers used to make a joint. With a given electrode and joint design, the tensile strength increases and the ductility and soundness tend to decrease as the number of beads or passes used to complete the joint increases. The influence of the number of passes on the tensile properties of a weld is shown by Table IV. These results were obtained from all-weld-metal tensile specimens machined from welds deposited with a shielded-arc type electrode on low carbon steels.

TABLE IV

Typical Effect of Welding Procedure on the Physical Properties of a Weld

No. of passes..	6	9	12	18
Current	125	125	125	125
Arc volts	22	22	22	22
Yield point, lb./sq. in. ...	44,725	46,350	57,250	60,500
Ultimate strength, lb./sq. in. ...	60,425	63,000	67,625	71,065
Elongation per cent in 2 in..	26.0	21.4	15.5	14.2
Reduction of area, per cent.	45.0	37.6	29.1	23.9

The reason there is a tendency for the weld soundness to decrease as the number of passes increases is because the molten deposited metal requires a certain amount of puddling to aid in removing inclusions and entrapped gas. The use of layers instead of beads to weld a joint is the general method used to reduce the number of passes required in welding a joint. The deposition of layers inherently require a certain amount of puddling. Consequently, with such a



Different procedures for depositing weld metal.

TABLE V

Physical Properties of Welds Made on Low Carbon Steels

Type of Electrodes or Welding Process	Yield Point Lb./Sq. In.	Tensile Strength Lb./Sq. In.	Elongation Per Cent in 2 In.	Elongation by Free Bend Per Cent	Reduction of Area in Per Cent	Endurance Limit Lb. Sq. In.	Impact Strength Ft. Lb.	Density in Gms/C.C.
Grade E-30GP (bare, sulcoat, dusted and washed)	35–40,000	50–60,000	5–8	10–14	15–20	16–20,000	5–15	7.5–7.7
Grade E-10, E-20 and E-20GP (heavy coated or shielded arc)	42–55,000	60–70,000	24–35	30–60	45–65	26–30,000	40–50	7.81–7.85
Grade E-40GP (shielded arc—high speed fillet electrodes)	55–65,000	70–80,000	20–25	25–40	28–35	26–30,000	30–45	7.8–7.85
Carbon Arc Welding (no shielding)	35–40,000	45–55,000	0–8	0–10	0–10	12–15,000	2–8	7.5–7.6
Carbon Arc Welding (shielded atmosphere)	53–63,000	70–80,000	20–25	30–40	28–35	26–30,000	30–45	7.8–7.84

procedure sounder welds may be expected. Also, the puddling required when depositing weld metal in layers causes greater heating at a given point which results in more complete grain refinement of the previous layer or layers. This, of course, results in increasing the weld ductility and slightly lowering the tensile strength.

(3) The residual stresses and distortion obtained when welding a joint is a junction of the number of beads. The greater the number of beads, the higher the residual stresses and distortion. As a result, layers are sometimes used to eliminate these objectionable factors.

(4) Vertical welds can be welded either from the top down or from the bottom up. Downward welding consists of string or narrow beads, while upward welding consists of depositing the weld metal in layers. In line with the previous discussion, therefore, vertical welds made by welding downward generally have higher tensile strength, lower ductility, and more porosity than vertical welds made by welding upward. Also, such welds generally produce more distortion.

The fact that welds made with both bare and shielded-arc electrodes have tensile strengths equal to or superior to low-carbon steels, makes it advantageous to choose a welding procedure that will give maximum ductility and soundness combined with minimum distortion. The following recommended welding procedures are, accordingly, based upon this requirement.

In all cases, the welding speeds given do not take into consideration such variables as fatigue or lost time resulting from poor joint fit-up and positioning of the structure to facilitate welding.

The physical properties of welds made on low carbon steels by using different types of electrodes and welding processes are given in Table V. The filler metal or electrodes in all cases are low carbon steels of grades E-10, E-20, E-20GP, E-30 GP, and E-40GP as specified by the American Welding Society **Tentative Specifications for Filler Metal.**

The values given in Table V are for welds in the "as welded" condition. Welds that are strain annealed will have tensile strengths from 5 to 10 per cent lower and ductility values from 5 to 10 per cent higher than those given. The changes resulting from strain annealing are more pronounced for shielded-arc electrodes than for bare, dust-coated, or washed electrodes.

Medium Carbon Steels—(SAE-1040)

Medium carbon steels are generally considered to be those steels having a carbon range from 0.30-0.45 per cent. The chemical analysis and physical properties of steels of this grade are given in Table VI.

TABLE VI

Chemical Analysis of Medium Carbon Steels (SAE 1040)

Carbon	0.30–0.45 per cent
Manganese	0.60–0.90 per cent
Silicon	0.10 max.
Phosphorus	0.050 max.
Sulphur	0.05 max.

Physical Properties of Medium Carbon Steels (SAE 1040)

Yield point, lb./sq. in.	40–45,000
Tensile strength, lb./sq. in.	70–80,000
Elongation, per cent in 2 in.	24–30
Reduction of areas, per cent	40–60
Endurance limit, lb./sq. in.	30–33,000

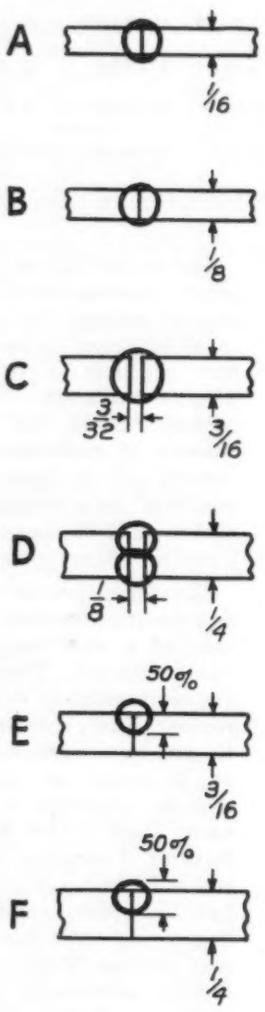
The weldability of steels of this grade depends upon the carbon content because the rapid cooling resulting from the welding operation produces a martensitic or troostitic structure. The lower the carbon content, the smaller the amount of austenite or troostite formed, and the better the welding qualities. As a result, it is desirable to hold the carbon content as close to .30 per cent as possible.

The formation of a martensitic or troostitic structure in the fusion zone of a weld makes this area hard and brittle. These hard areas are detrimental in welding for two reasons. First, such areas are brittle and have a tendency to crack as a result of the shrinkage stresses occurring when the weld cools. These cracks may be in the form of a complete separation of the weld and parent metal or as hair line cracks which are not visible to the eye. Hair line cracks may produce failure of the weld in service particularly if it is subjected to dynamic loads. Second, if the welded surface is to be machined, the hard areas cause machining troubles.

The fact that the rate of cooling from above the critical range is responsible for the hardness obtained in the fusion zone of welded medium carbon steels suggests a remedy. Preheating the base metal prior to welding tends to slow down the rate of cooling and consequently reduces the percentage increase in hardness obtained. This procedure aids in preventing cracks during the welding process.

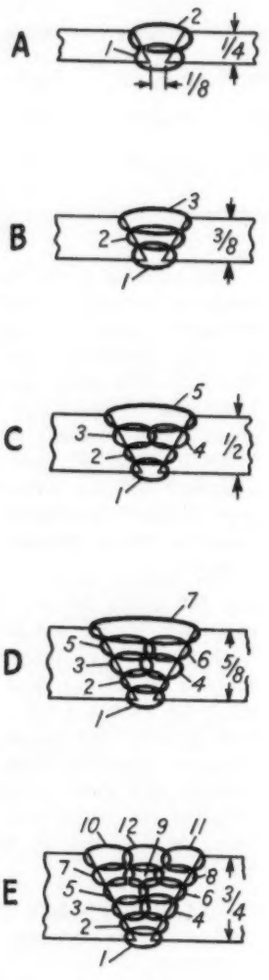
Preheating temperatures of 350 to 500 deg. F. have been found effective. The higher preheating temperature produces the most satisfactory results, but many

(CONTINUED ON PAGE 45)



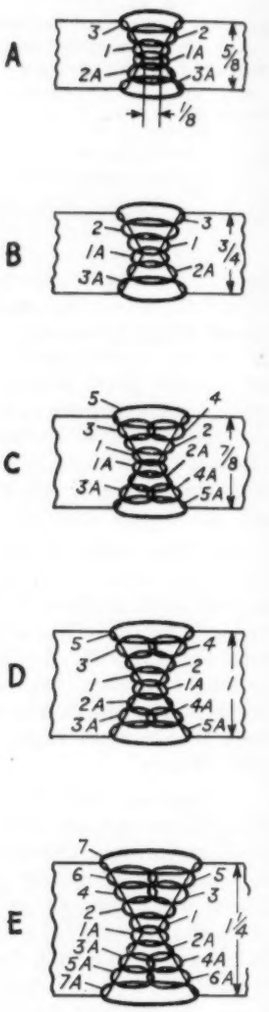
Square Butt Joints
Bare Type Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	80	45.0	0.029
B	1	1/8	120	30.0	0.053
C	1	5/32	160	20.0	0.090
D	2	3/16	190	13.6	2.00
E	1	5/32	160	40.0	0.045
F	1	3/16	190	28.0	1.10



60 Deg. Single Vee Butt Joints, Down Hand Position
Bare, Washed or Coated Electrodes

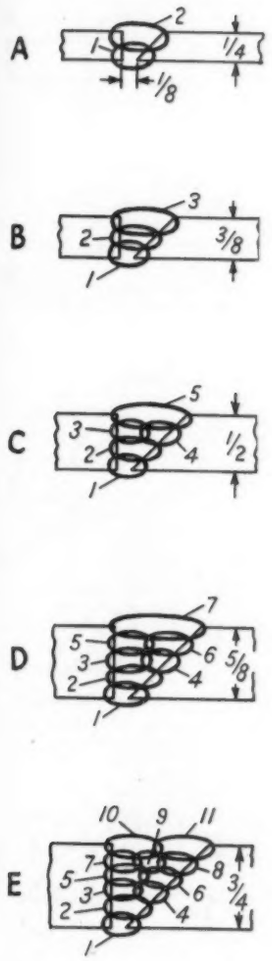
Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	160		
	2	3/16	190	12.5	0.21
B	1	5/32	160		
	2 and 3	3/16	190	7.8	0.46
C	1	5/32	160		
	2 to 5 inc.	3/16	190	5.0	0.70
D	1	5/32	160		
	2 to 7 inc.	3/16	190	3.5	1.1
E	1	5/32	160		
	2 to 12 inc.	3/16	190	2.5	1.5

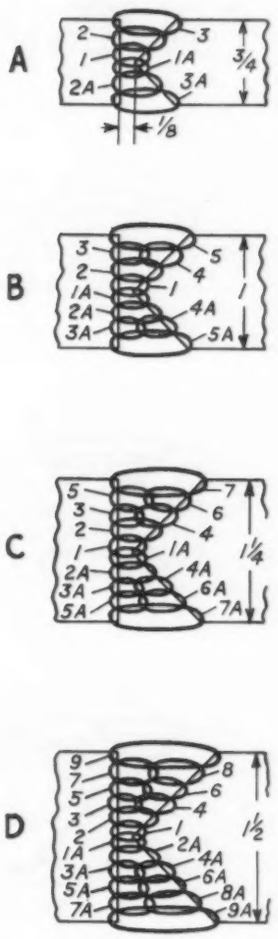


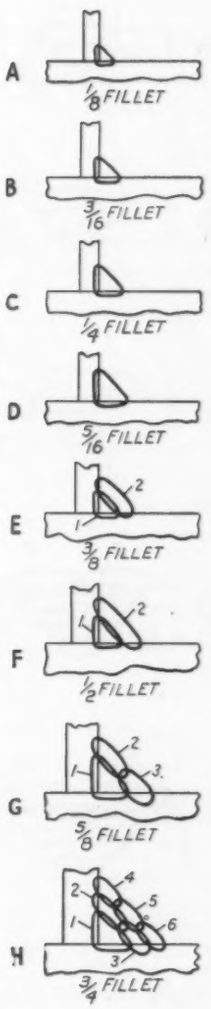
60 Deg. Double Vee Butt Joints, Down Hand Position
Bare, Washed or Coated Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	All passes	3/16	190	4.2	0.72
B	All passes	3/16	190	3.2	0.90
C	All passes	3/16	190	2.4	1.1
D	All passes	3/16	190	1.9	1.40
E	All passes	3/16	190	1.3	2.10

Data for Various Welds







45 Deg. Single Bevel Butt Joints, Down Hand Position
Bare, Washed or Coated Electrodes

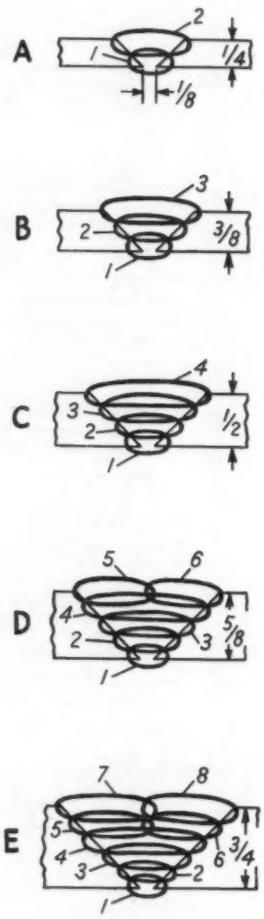
Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	160		
	2	5/16	190	16.5	0.16
B	1	5/32	160		
	2 and 3	5/16	190	10.3	0.35
C	1	5/32	160		
	2 to 5 inc.	5/16	190	6.6	0.53
D	1	5/32	160		
	2 to 7 inc.	5/16	190	4.6	0.84
E	1	5/32	160		
	2 to 10 inc.	5/16	190	3.3	1.2

45 Deg. Double Bevel Butt Joints, Down Hand Position
Bare, Washed or Coated Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1 and 1A	5/32	160		
	other passes	5/16	190	4.6	0.55
B	1 and 1A	5/32	160		
	other passes	5/16	190	2.6	1.0
C	1 and 1A	5/32	160		
	other passes	5/16	190	1.7	1.6
D	1 and 1A	5/32	160		
	other passes	5/16	190	1.2	2.5

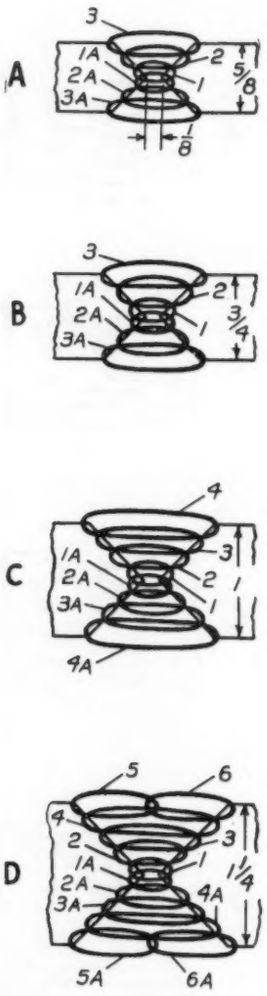
Fillet Welds, Horizontal Position
Bare, Washed or Coated Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	150	36	0.07
B	1	5/32	150	26	0.10
C	1	5/16	190	20	0.15
D	1	5/16	190	15	0.24
E	1 and 2	5/16	190	12	0.29
F	All passes	5/16	190	7	0.58
G	All passes	5/16	190	4.5	0.78
H	All passes	5/16	190	3.1	1.2



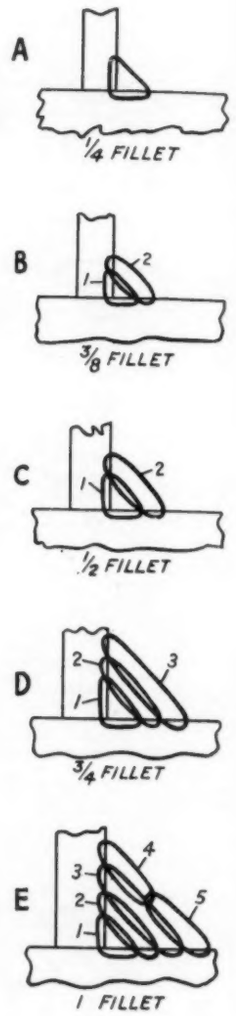
90 Deg. Single Vée Butt Joints, Vertical Position
Bare, Washed or Coated Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	135		
	2	5/32	160	10.5	0.26
B	1	5/32	135		
	2 and 3	3/16	160	6.6	0.48
C	1	5/32	135		
	2 to 4 inc.	3/16	160	4.3	0.81
D	1	5/32	135		
	2 to 6 inc.	3/16	160	3.0	1.2
E	1	5/32	135		
	2 to 8 inc.	3/16	160	2.1	1.6



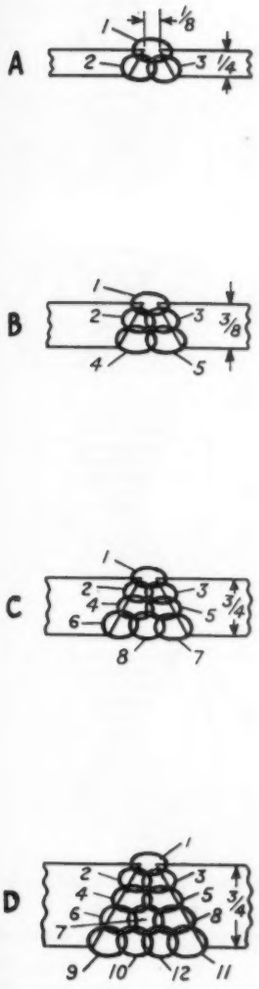
90 Deg. Double Vee Butt Joints, Vertical Position
Bare, Washed or Coated Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1 and 1A	5/32	135		
	all others	3/16	160	3.6	0.97
B	1 and 1A	5/32	135		
	all others	3/16	160	2.7	1.3
C	1 and 1A	5/32	135		
	all others	3/16	160	1.6	2.2
D	1 and 1A	5/32	135		
	all others	3/16	160	1.1	3.1



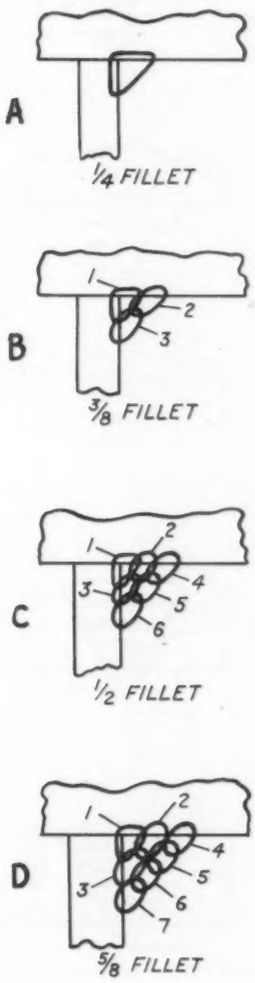
Fillet Welds, Vertical Position
Bare, Washed or Coated Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	135	17	0.16
B	1	5/32	135		
	2	5/16	160	10	0.30
C	1	5/32	135	6.0	0.59
	2	5/16	160		
D	1	5/32	135		
	all others	5/16	160	2.6	0.79
E	1	5/32	135		
	all others	5/16	160	1.7	1.3



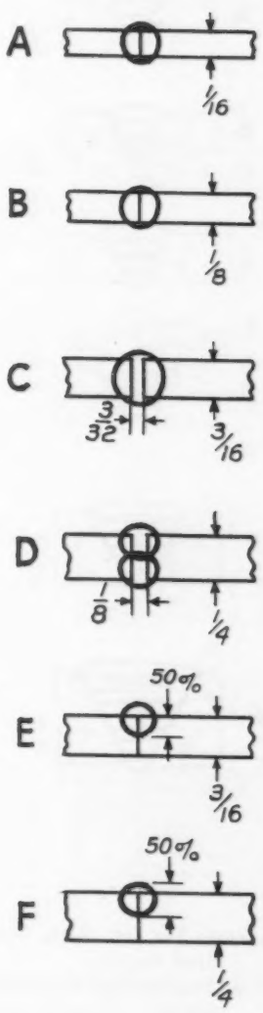
60 Deg. Single Vee Butt Joints, Overhead Position
Bare, Washed or Coated Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	1/8	100		
	2 and 3	5/32	130	6.8	0.20
B	1	1/8	100		
	2 to 5 inc.	5/32	130	4.0	0.45
C	1	1/8	100		
	2 to 8 inc.	3/16	150	2.6	0.71
D	1	1/8	100		
	2 to 12 inc.	3/16	150	1.3	1.6



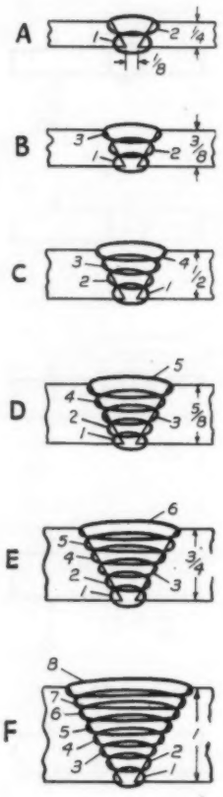
Fillet Welds, Overhead Position
Bare, Washed or Coated Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	130	12	0.15
B	1	5/32	130		
	2 and 3	3/16	150	7.0	0.29
C	1	5/32	130		
	all other	3/16	150	3.8	0.58
D	1	5/32	130		
	all other	3/16	150	2.7	0.78



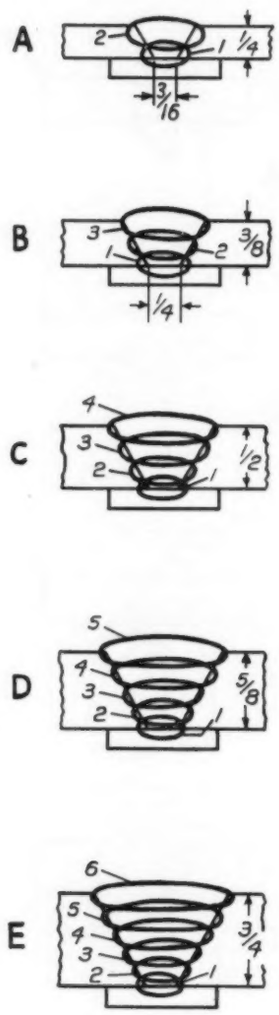
Square Butt Joints, Down Hand Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	75	80.0	0.020
B	1	1/8	115	51.0	0.054
C	1	5/32	152	35.0	0.090
D	2	3/16	190	24	1.2
E	1	5/32	150	68	0.05
F	1	3/16	190	45	0.70



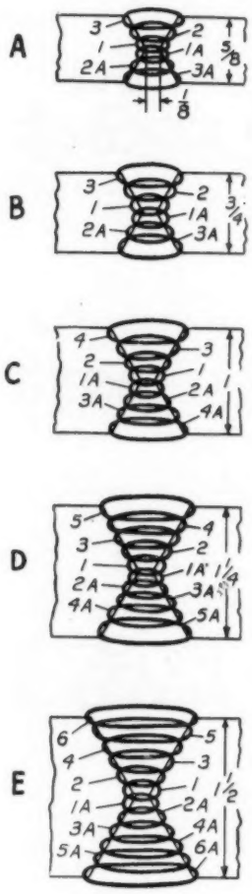
60 Deg. Single Vee Butt Joints, Down Hand Position Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	150		
	2	3/16	190	17	0.35
B	1 and 2	3/16	190		
	3	1/4	280	10.5	0.60
C	1 and 2	3/16	190		
	3 and 4	1/4	280	6.6	1.0
D	1 and 2	3/16	190		
	3 to 5 inc.	1/4	285	4.8	1.4
E	1 and 2	3/16	190		
	3 to 6 inc.	1/4	285	3.5	1.8
F	1 and 2	3/16	190		
	3 to 8 inc.	1/4	285	2.3	2.8



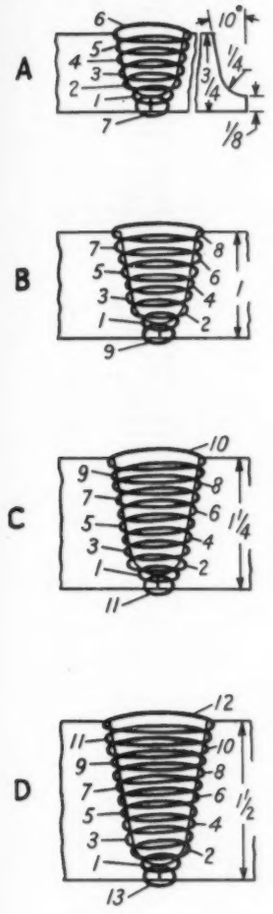
60 Deg. Single Vee Butt Joints with Backup, Down Hand Position Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	3/16	190		
	2	3/16	190	19	0.43
B	All passes	1/4	285	12.5	0.72
C	All passes	1/4	285	7.5	1.2
D	All passes	1/4	285	5.3	1.7
E	All passes	1/4	285	4.0	2.2



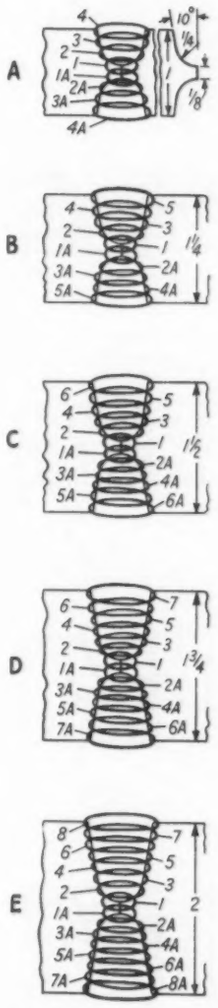
60 Deg. Double Vee Butt Joints, Down Hand Position Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1 and 2	3/16	190		
	3	1/4	285		
	1A	3/16	190		
	2A and 3A	1/4	285	6.0	1.0
B	1 and 2	3/16	190		
	3	1/4	285		
	1A	3/16	190		
	2A and 3A	1/4	285	5.3	1.3
C	1 and 2	3/16	190		
	3 and 4	1/4	285		
	1A	3/16	190		
	2A to 4A inc.	1/4	285	3.8	2.1
D	1 and 2	3/16	190		
	3 to 5 inc.	1/4	285		
	1A	3/16	190		
	2A to 5A inc.	1/4	285	2.8	2.5
E	1 and 2	3/16	190		
	3 to 6	1/4	285		
	1A	3/16	190		
	2A to 6A inc.	1/4	285	1.9	4.5



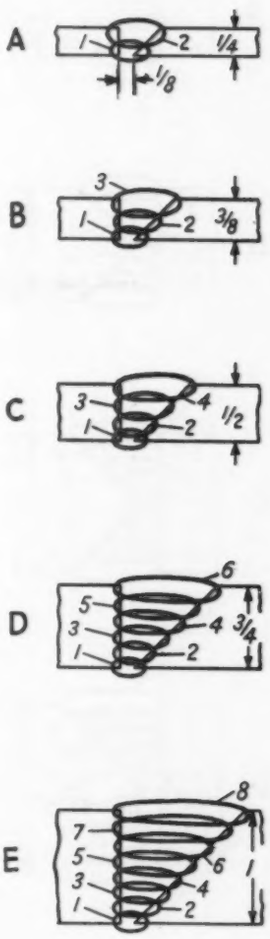
Single U Butt Joints, Down Hand Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/16	190		
	All others	1/4	285	4.5	2.0
B	1	5/16	190		
	All others	....	285	3.1	2.9
C	1	5/16	190		
	All others	1/4	285	2.4	3.8
D	1	5/16	190		
	All others	1/4	285	1.8	4.8



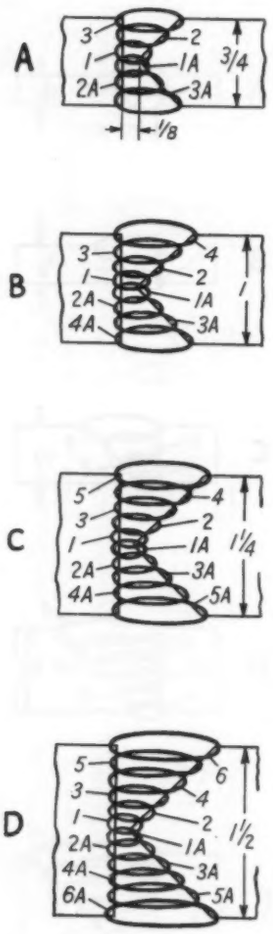
Double U Butt Joints, Down Hand Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1 and 1A	5/16	190		
	All others	1/4	285	3.7	2.3
B	1 and 1A	5/16	190		
	All others	1/4	285	2.7	3.1
C	1 and 1A	5/16	190		
	All others	1/4	285	2.2	3.9
D	1 and 1A	5/16	190		
	All others	1/4	285	1.6	5.0
E	1 and 1A	5/16	190		
	All others	1/4	285	1.4	6.2



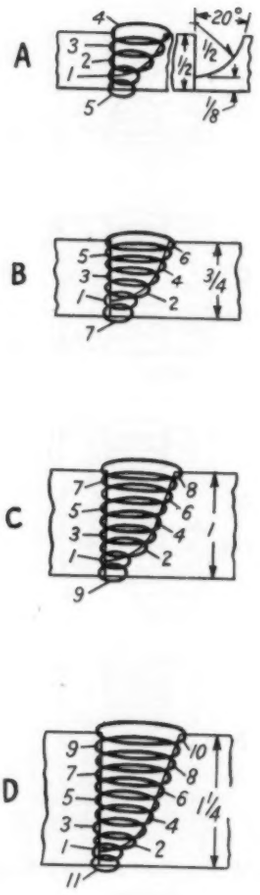
45 Deg. Single Bevel Butt Joints, Down Hand Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	160	17.0	0.35
	2	5/16	190		
B	1 and 2	5/16	190		
	3	1/4	280	11.0	0.58
C	1 and 2	5/16	190		
	3 and 4	1/4	285	7.8	0.82
D	1 and 2	5/16	190		
	All others	1/4	285	4.2	1.4
E	1 and 2	5/16	190		
	Others	1/4	285	2.7	2.4



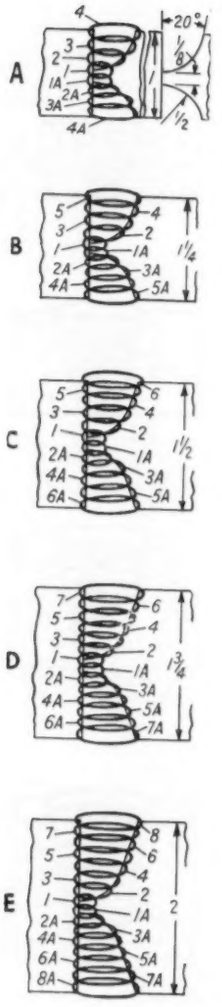
45 Deg. Double Bevel Butt Joints, Down Hand Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1 and 2	5/16	190		
	1A and 2A	5/16	190		
	3 and 3A	1/4	285	5.0	1.2
B	1 and 2	5/16	190		
	1Aand 2A	5/16	190		
	All others	1/4	285	3.9	1.64
C	1 and 2	5/16	190		
	1A and 2A	5/16	190		
	All others	1/4	285	2.8	2.2
D	1 and 2	5/16	190		
	1A and 2A	5/16	190		
	All others	1/4	285	2.1	2.8



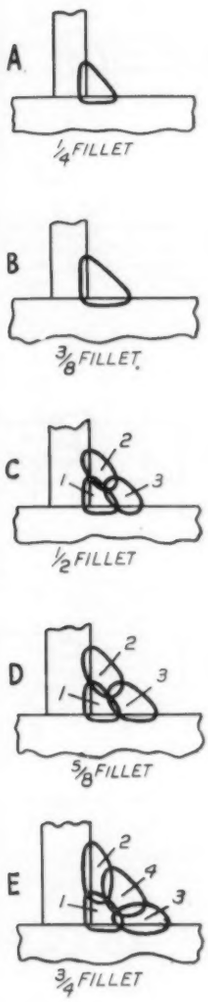
Single J Joints, Down Hand Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/16	190		
	All others	1/4	285	4.7	1.2
B	1	5/16	190		
	All others	1/4	285	3.5	1.75
C	1	5/16	190		
	All others	1/4	285	2.7	2.5
D	1	5/16	190		
	All others	1/4	285	2.0	3.3



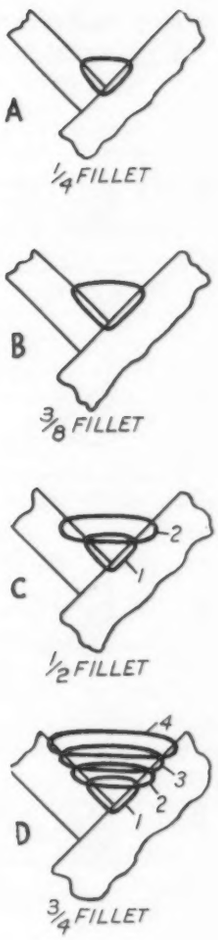
Double J Joins, Down Hand Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1 and 1A	5/16	190		
	All others	1/4	285	2.7	2.5
B	1 and 1A	5/16	190		
	All others	1/4	285	2.0	3.0
C	1 and 1A	5/16	190		
	All others	1/4	285	1.6	3.9
D	1 and 1A	5/16	190		
	All others	1/4	285	1.4	4.4
E	1 and 1A	5/16	190		
	All others	1/4	285	1.3	5.0



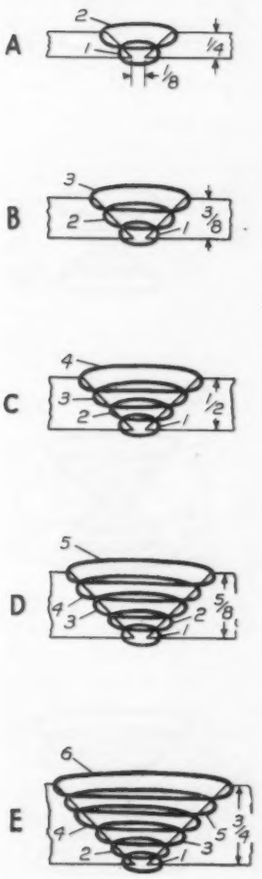
Fillet Welds, Horizontal Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	3/16	190	30.0	0.18
B	1	1/4	240	21.0	0.37
C	All passes	1/4	240	12.0	0.67
D	All passes	1/4	240	7.0	0.95
E	All passes	1/4	240	4.7	1.7



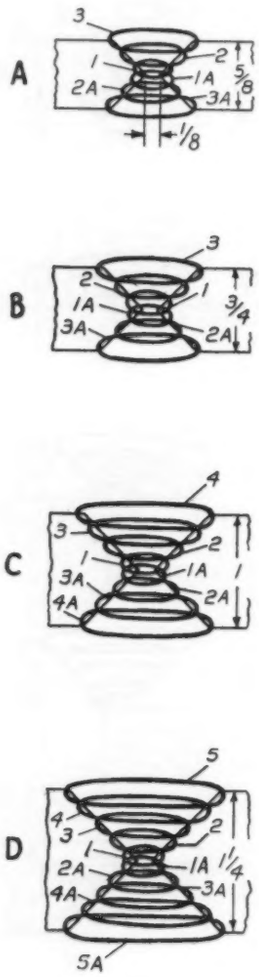
Fillet Welds, Down Hand Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	3/16	190	33.0	0.17
B	1	1/4	285	24.0	0.36
C	All passes	1/4	285	14.0	0.66
D	All passes	1/4	285	6.0	1.5



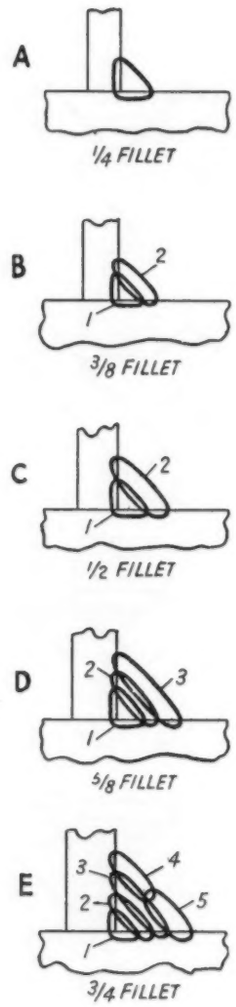
90 Deg. Single Vee Butt Joint, Vertical Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	125		
	2	3/16	140	15.0	0.30
B	1	5/32	125		
	All others	3/16	140	9.1	0.57
C	1	5/32	125		
	All others	3/16	140	5.5	0.97
D	1	5/32	125		
	All others	3/16	140	3.9	1.40
E	1	5/32	125		
	All others	3/16	140	2.9	1.9



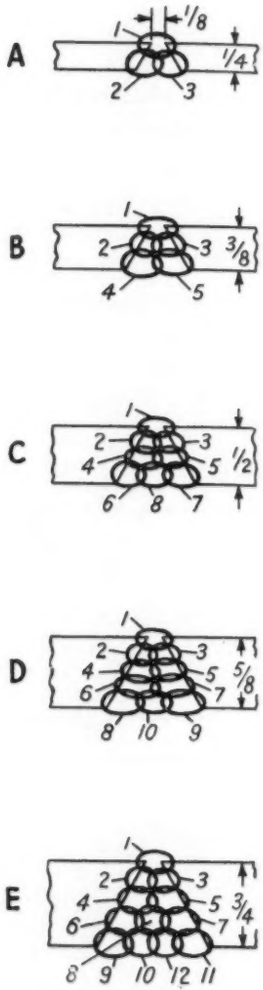
90 Deg. Double Vee Butt Joint, Vertical Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1 and 1A	5/32	125		
	Other passes	3/16	140	5.8	0.80
B	1 and 1A	5/32	125		
	Other passes	3/16	140	4.5	1.14
C	1 and 1A	5/32	125		
	Other passes	3/16	140	2.7	2.0
D	1 and 1A	5/32	125		
	Other passes	3/16	140	2.0	2.80



Fillet Welds Vertical Position
Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	125	25.0	0.2
B	1	5/32	125		
	1	3/16	140	13.0	0.40
C	1	5/32	125		
	2	3/16	140	7.3	0.70
D	1	5/32	125		
	2 and 3	3/16	140	4.1	1.1
E	1	5/32	125		
	All passes	3/16	140	3.2	1.7

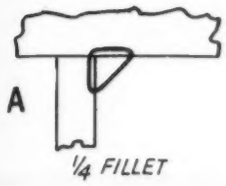


60 Deg. Single Vee Butt Joints, Overhead Position
Coated or Shielded Arc Electrodes

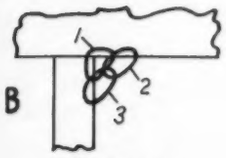
Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	3/8	100		
	2 and 3	5/32	125	9.0	0.32
B	1	3/16	100		
	All others	5/32	125	6.0	0.58
C	1	3/16	100		
	All others	3/16	140	3.5	0.98
D	1	3/16	100		
	All others	3/16	140	2.4	1.2
E	1	3/16	100		
	All others	3/16	140	1.8	1.6

How to Weld 29 Metals

(CONTINUED FROM PAGE 35)



1/4 FILLET



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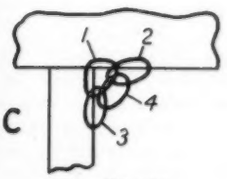

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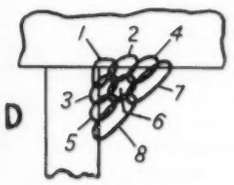


5/8 FILLET

Fillet Welds Overhead Position Coated or Shielded Arc Electrodes

Joint Design	Passes	Electrode Dia. in Inches	Current in Amperes	Welding Speed in Ft./hr.	Pounds of Electrode Per Foot
A	1	5/32	125	17.0	0.20
B	1	5/32	125		
	2 and 3	3/16	140	9.0	0.40
C	1	5/32	125		
	All others	3/16	140	6.0	0.70
D	1	5/32	125		
	All others	3/16	140	4.1	1.1

times it is prohibitive because of the hardship it imposes on the welding operators.

Subsequent heat-treatment after welding will anneal the hard areas and reduce their hardness and increase their ductility. Heat-treating temperatures of 1100 to 1200 deg. F. are very effective, but higher temperatures produce more pronounced changes. In many cases, heat-treating temperatures of 1450 deg. F. are recommended. Heat-treatment after welding will restore the desired properties to the affected areas but it will not prevent troubles encountered during the welding process.

For most structures made of medium carbon steels, it is recommended that subsequent heat-treatment be used even though pre-heating has been used. This is particularly true for steels containing more than 0.40 per cent carbon.

Medium carbon steels may be welded successfully with both bare and shielded-arc type electrodes. When welding with bare type electrodes, the welding operator must take special care to use sufficient welding current and to puddle the deposited metal properly. The higher percentage of carbon present forms a gas which must be allowed to escape in order to prevent porosity in the weld and in fusion zone. The same condition is true when welding with shielded-arc electrodes, but as a rule less trouble is encountered from porosity.

Bare electrode welds will have their characteristic brittle structure and the tensile properties will be inferior to that of the parent metal. Typical results are tabulated in Table VII.

TABLE VII

Properties of Welds on Medium Carbon Steels Made with Bare Electrodes

Yield point, lb./sq. in.	40,000
Tensile strength, lb./sq. in.	60,000
Elongation, per cent in 2 in.	8
Elongation, per cent by free bend.	12
Reduction of area, per cent	8
Endurance limit, lb./sq. in.	15,000
Impact strength, ft. lb.	5

Welds made with high-grade shielded-arc electrodes will produce welds with physical properties comparable to the parent metal. Heat treatment after welding tends to lower the tensile strength slightly and increase the ductility. Typical properties of welds made with shielded-arc electrodes are tabulated in Table VIII.

TABLE VIII

Physical Properties of Welds Made on Medium Carbon Steel with Shielded-Arc Electrodes

	As Welded	Annealed 1100° F.
Yield point, lb./sq. in.	45,000	43,000
Tensile strength, per cent	70,000	67,000
Elongation, per cent in 2 in.	24	30
Elongation, per cent by free bend	40	43
Reduction of area, per cent	30	35
Endurance limit, lb./sq. in.	26,000	26,000
Impact ft. lb.	40	41

High Carbon Steels

Steels considered in this group contain carbon contents ranging from 0.50 to 0.80 per cent and are welded only in special cases. Their weldability is poor because of the marked hardness and brittleness obtained in the fusion zone. As a result, steels containing carbon contents in excess of the amount obtained in this group are not recommended for arc welding.

When discussing the higher carbon steels, it is important to point out that fusion welding is applied to them for two purposes—to build up a worn surface or to join one metal to another. The building up of a worn surface is the easier of the two welding applications and can be done successfully with both bare and shielded-arc type electrodes. In such cases, preheating is desirable but not always necessary. The success of the welding operation is dependent upon the fact that the deposited metal is free to contract thereby preventing the development of high residual stresses which would tend to fracture the joint at the fusion zone. Steel rails fall in this group and it is common practice to build up battered ends by arc welding with both bare and shielded-arc electrodes. In most cases, bare electrodes of high carbon content are used.

(TO BE CONTINUED NEXT WEEK)

THIS WEEK ON THE ASSEMBLY LINE

. . . Automotive production reaches new high for the year at 122,960 units, but holidays will cut into this week's output.

o o o

. . . Libbey-Owens-Ford strike makes plate glass the outstanding factor that may influence automotive production in coming weeks.

o o o

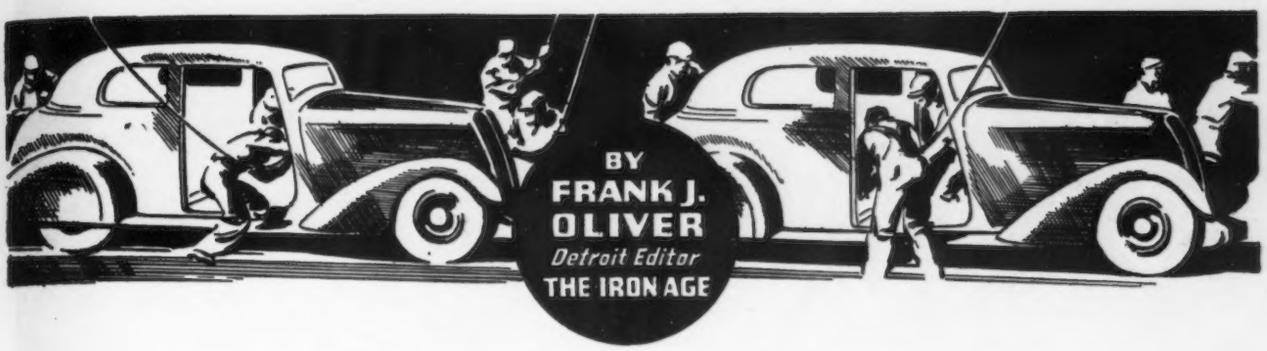
Latest report is that Ford will shut down for a possible ten days beginning Dec. 24. Today Chrysler issued an indefinite hold-up order on parts supplied from the outside for Plymouth and Dodge. All signs point to an industry-wide tie-up with the big three closing and reopening simultaneously. A break is seen in the Kelsey deadlock as workers ask for conference.

DETROIT, Dec. 22—Production climbed to another record high for the month and for the year, as all automobile companies worked feverishly to make up for the low weeks that are to follow because of the holidays falling on Friday. Many Detroit plants will close down at noon Thursday of this week, making it a 3½-day week so far as production is concerned. The same condition will probably be true next week.

Output of passenger cars and trucks in the United States and Canada is estimated at 122,960 units for the week ended Dec. 19, against 119,660 units for the previous week, according to Ward's Automotive Reports. This compares with assemblies of 108,421 units for the identical period a year ago. General Motors gained another 1000 units to 54,250 and Chrysler boosted its output over 2000 units to 26,500. Ford's production remained practically fixed at 25,750 units. Next week's production should be down by approximately one-third, owing to the short work week. Further reductions are anticipated in some quarters from a shortage of plate glass, owing to labor difficulties in that industry.

The Detroit Board of Commerce's index of employment rose to a new high for the year of 122.2 as of Dec. 15, the highest figure, incidentally, recorded since Sept. 1929, and only 15 points below the all-time high established in March, 1929. The index is based on average monthly employment during the years 1923-25. Part of this increase can be attributed to the Ford Motor Co., which has been engaged in a large hiring program for the past two weeks. Over 16,000 workers were hired last week and the present rate is about 500 a day. The total payroll at the Rouge plant will soon reach 90,000, the largest number established since the depression. Explanation lies in one of two directions: either that Ford is going to a 6-hr. day, 6-day week, as has been rumored around the city and in the plant, or that he is establishing a 5-day week of 40 hrs., but a 6-day factory schedule. This would mean that workers would have to be staggered as to their day off during the six days and that approximately 20 per cent more workers would have to be hired. Ford production has been sticking very close to 5000 units a day, although equipment has been purchased in recent weeks in large volume to step up the output of the motor lines to 7000 units total on the small and the big engine. In line with the general trend in the industry, Ford has quietly been putting through pay increases in the past week and approximately 50,000 workers have thus far been affected. Today the base rate at Ford is practically 80c an hr., although new hiring takes place at the 75c an hr. minimum.

Employment is up in other plants. Olds Motor Works reported 12,195 on the payroll last week, the highest in its history and more than



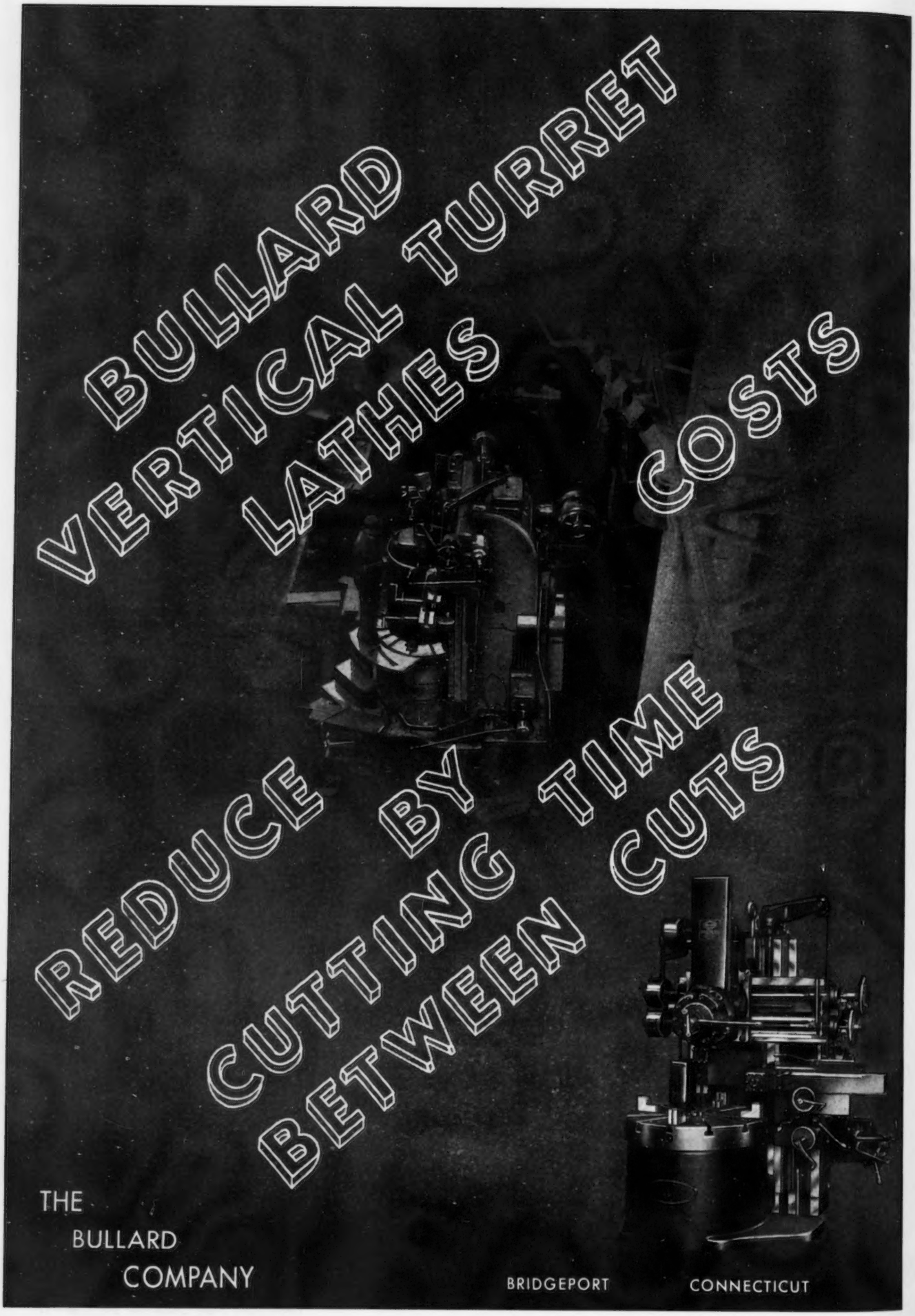
2000 over the peak established a year ago. Oldsmobile also topped 1100 units off its assembly line last week. Buick is running over 12,000 workers on its payroll at present and Pontiac is running close to 10,000, the highest in the company's history.

Sales Volume Large

These high figures of employment are partly explained by the fact that the industry as a whole and particularly the Big Three, are definitely striving to attain a 40-hr. week. Production is at a high level, also, because of the fine volume of sales which continue to be reported. Deliveries of Buick cars during the first 10 days of December exceeded all records for this period by nearly 2 to 1. Total was 6672 cars. Buick has been stepping up its production schedules steadily from month to month and expects to reach an all-time high in December with an output of approximately 30,000 cars. Oldsmobile delivered 6739 cars for the first 10 days, recording a 52 per cent increase over the same period in 1935. Its output for December is expected to be 25,000 units. Pontiac more than doubled its sales for the first 10 days of December, when its dealers delivered 6979 units. Studebaker showed a gain of 38 per cent for the first 10 days of December over 1935 and Graham retail deliveries indicate an estimated gain in shipments for the final quarter of 73 per cent over the 1935 figure.

Whereas it is generally conceded that the automotive industry had committed itself by early December for roughly half of its 1937 model steel requirements, it must be remembered that the automobile year is only 10 months long and production in the second half begins the first of March. Hence it is not at all surprising to find that already some rather substantial commitments have been made on steel for delivery in February and early March. As a result of the unprecedented volume of orders coming into the mills, particularly on strip and sheets, the delivery situation is not easing any and certain items such as terne plate are being quoted as long as 10 weeks. Steel for March fabrication should be coming into the automobile plants in February, so that substantial purchases are expected before the end of the year at first-quarter prices.

CHEVROLET is using one of the first Cincinnati automatic die sinkers with integral hydraulic control. Master pattern is at *A*, while the cutter is sinking the drop-forge die at *B*. The hydraulic control makes possible a deeper cut and a 30 per cent increase in speed over previous methods.


BULLARD
VERTICAL TURRET
LATHES
REDUCE COSTS
BY
CUTTING TIME
BETWEEN CUTS
THE
BULLARD
COMPANY
BRIDGEPORT
CONNECTICUT

With production going as it is, the mills are being crowded on delivery and the only possible hold-up is labor difficulties.

Plate Glass Chief Worry

Overshadowing all the sporadic sit-down strikes that have occurred in various parts plants during the past few weeks in Detroit is the situation in plate glass. Whereas a week ago the possibility of an early settlement of the Pittsburgh Plate Glass strike seemed imminent, the matter of a settlement seems less hopeful now than then. The matter has been further complicated by the complete shut-down of all Libbey-Owens-Ford plants on Dec. 15. Negotiations had been going on since Dec. 6 between the officials of Libbey-Owens-Ford and the Federation of Flat Glass Workers. The strike came as a distinct shock and surprise to Toledo, since the company had had amiable relations with this union for years. The company has at no time discouraged any of its employees from joining any union and has never failed to deal with the union officials. But when Mr. McCabe, president of the Flat Glass Workers, and his committee demanded an out-and-out closed shop and the "check-off," the company balked. L-O-F does not want to have anything to do with the collection of union dues, fines and assessments for the union.

It had planned to distribute half of a $750,000 bonus amounting to $50 each to its employes on the very day that the strike occurred. It had offered wage increases which would have added $580,000 to its payroll and would have meant that the average workers would have been paid $1725 on the average in 1937, assuming that he worked the same amount of time as this year. The union asked for a 10c. an hour increase in wages and a 25 per cent bonus for straight hourly workers, which would have added $2,700,000 to the payroll. The company also balked at this, together with the long string of fantastic demands, which they considered impossible to accept.

Pittsburgh Plate Glass went out of production on Oct. 24. It is estimated that there was a bank of finished glass on hand for about 60 days' production of the Chrysler Corp., its principal customer. On this basis, it will not be long before Chrysler is affected, unless a settlement is quickly negotiated. On the same basis General Motors should be able to run for at least another two months from the date of L-O-F's closing. There is another source of supply in Canada, but the output is so small as to be no factor in the situation. Ford Motor Co. is the only one of the Big Three which is not immediately worrying about glass, since the company has its own glass making facilities and has a large bank of finished glass in outdoor storage at the Rouge plant.

May Be Shortage of Wheels

What may embarrass Ford more is an ultimate shortage of wheels. Kelsey-Hayes Wheel Co. in Detroit has been shut down tight since Dec. 14 after a series of three sit-down affairs. Kelsey-Hayes has been supplying the bulk of Ford wheels, although Ford has some capacity itself in this connection. There are now four sets of brake tools available, so that there should be no shortage of these wheel parts. Ford give a fair percentage of its volume to Budd Wheel Co. during the Bendix sit-down strike and also tooled up at Rouge. Now what business Kelsey-Hayes had on brake assemblies will probably go back to Bendix, at least for the present. Parts sub-contractors to Kelsey-Hayes are continuing to fabricate components, however, although none are being shipped.

The Kelsey-Hayes Wheel strike has been deadlocked since Dec. 14. That morning the third set of demands made by the strikers committee met with a flat "No" by the management, who refused to arbitrate further, after conceding a 75c. an hour minimum the previous Saturday. The company will not negotiate further until all sit-down strikers leave the plant and the rest of the force come back to work. Out of 5000 workers employed, the company estimates that less than 200 are still in the plant. The union's most conservative estimate is 700.

The sit-down strike in the Detroit plant of the Aluminum Co. of America is also deadlocked. Beginning as a spontaneous affair on the night shift of the extrusion plant, it spread to the point where both the extrusion and foundry plants were shut down completely. The management has consistently refused to talk with officers of the United Automobile Workers, who have been feeding the sit-in strikers and who claim they have now signed up as members all within the plant and a goodly percentage of those without. This particular plant supplies aluminum cylinder heads, manifolds and other automotive aluminum castings chiefly to the Ford Motor Co., but since there are two other sources of supply on these parts, there is little likelihood that even an indefinite deadlock at this plant will materially alter Ford's production.

Pending realinement of new sources of supply already mentioned several branch assembly lines shut down for a few days beginning Monday. Night shift workers at Rouge plant were sent home Friday evening, but the plant was running Monday.

William S. Knudsen, in opening Indianapolis truck body plant of General Motors, said he did not want to discourage organization of any sort, but thought collective bargaining should take place before a shutdown rather than after. General Motors' set-up provides regular channels for presentations of grievances right up to top in Detroit if necessary. On top of this a formal request for conference with G.M. officials was sent Monday by UAW union officials with hints of strike if the offer was refused. John Lewis in Washington on Saturday accused G.M. of widespread discrimination against members of the union, but gave Chrysler a clean bill of health. On the same day last week the Senate Civil Liberties Committee announced an inquiry into labor conditions in G.M. plants, hearings to begin Jan. 11. Charges of labor espionage were hinted.

W. J. Cameron of Ford says the 6-hr. day is in prospect for auto industry but if done prematurely too many difficulties would arise. It is not ready for it yet, he says. Ford had planned such a change in 1929, but the depression killed this program.

Other Labor Eruptions

Two other eruptions in labor circles took place last week. At Kansas City 600 or more employees of the Fisher Body plant were sitting down on a sympathetic strike because of the discharge of a Chevrolet employe who had violated a company regulation by leaping over an assembly line. This makes the second Fisher-Chevrolet plant to be tied up, since the workers are still out at Atlanta because of the dismissal of three workers for wearing union badges. These occurrences are indicative of the spontaneity of the sit-down strike and the very trivial matters that lead up to them. National Automotive Fibres, Inc., had a day-old sit-down strike at its Detroit plant because of the dismissal of 10 members of the shop bargaining committee. These men were later reinstated and pay increases of 5c an hour put through. Wages at this particular plant were much out of line with the average being paid in Detroit, largely because of the high percentage of women on the payroll.

Large Bonuses Distributed

Last week in Michigan about 300,000 men and women participated in $15,000,000 of cash disbursements made in the way of Christmas bonuses, including those

(CONTINUED ON PAGE 71)

Current Metal Working Activity Statistically Shown

These Data Are Assembled by The Iron Age from Recognized Sources and Are Changed Regularly as More Recent Figures Are Made Available.

	November, 1936	October, 1936	November, 1935	Eleven Months, 1935	Eleven Months, 1936
Raw Materials:					
Lake ore consumption (gross tons)[a]	4,269,049	4,384,809	3,025,694	27,760,943	40,087,983
Coke production (net tons)[b]	.....	4,307,849	3,217,175	31,720,422	.....
Pig Iron:					
Pig iron output—monthly (gross tons)[c]	2,947,365	2,991,887	2,065,913	18,901,349	27,503,760
Pig iron output—daily (gross tons)[c]	98,246	96,512	68,864	56,591	82,101
Castings:					
Malleable castings—production (net tons)[d]	.....	51,778	44,277	420,797	.....
Malleable castings—orders (net tons)[d]	.....	55,521	47,778	410,038	.....
Steel castings—production (net tons)[d]	.....	74,775	36,165	361,195	.....
Steel castings—orders (net tons)[d]	.....	59,431	32,714	359,618	.....
Steel Ingots:					
Steel ingot production—monthly (gross tons)[e]	4,337,412	4,545,001	3,150,409	30,344,580	42,487,717
Steel ingot production—daily (gross tons)[e]	173,496	168,333	121,170	106,100	148,558
Steel ingot production—per cent of capacity[e]	79.05	76.70	54.73	47.93	67.69
Finished Steel:					
Trackwork shipments (net tons)[c]	4,756	5,547	3,090	39,204	63,234
Steel rail orders (gross tons)[c]	123,875	119,237	81,721	445,020	927,940
Sheet steel sales (net tons)[f]	294,080	223,195	289,101	2,270,171	2,383,572
Sheet steel production (net tons)[f]	224,031	235,057	224,541	2,216,216	2,367,559
Fabricated shape orders (net tons)[g]	.....	127,303	91,693	972,368	.....
Fabricated shape shipments (net tons)[g]	.....	152,999	94,746	1,019,002	.....
Fabricated plate orders (net tons)[d]	.....	33,791	19,116	222,731	.....
Reinforcing bar awards (net tons)[c]	18,740	22,135	11,475	289,315	316,240
U. S. Steel Corpn. shipments (tons)[h]	882,643	1,007,417	681,820	6,709,784	9,757,767
Ohio River steel shipments (net tons)[i]	127,425	145,065	88,338	864,508	1,057,871
Fabricated Products:					
Automobile production, U. S. and Canada[k]	394,890	229,989	*408,550	*3,701,594	4,097,725
Construction contracts, 37 Eastern States[l]	$208,204,200	$225,839,900	$188,115,000	$1,580,408,400	$2,475,600,300
Steel barrel shipments (number)[d]	.....	924,797	634,396	6,331,077	.....
Steel furniture shipments (dollars)[d]	.....	$1,776,784	$1,591,286	$13,965,584	.....
Steel boiler orders (sq. ft.)[d]	.....	968,473	464,431	5,560,423	.....
Locomotive orders (number)[m]	.....	22	0	28	.....
Freight car orders (number)[m]	.....	1,310	25	8,128	.....
Machine tool index[n]	147.1	136.5	98.6	†93.8	†134.0
Foundry equipment index[o]	200.4	174.4	100.4	†122.9	†178.6
Foreign Trade:					
Total iron and steel imports (gross tons)[p]	.....	.....	56,637	45,461	.....
Imports of pig iron (gross tons)[p]	.....	.....	15,550	114,648	.....
Imports of all rolled steel (gross tons)[p]	.....	.....	17,089	193,851	.....
Total iron and steel exports (gross tons)[p]	.....	.....	205,242	2,828,067	.....
Exports of all rolled steel (gross tons)[p]	.....	.....	88,008	812,159	.....
Exports of finished steel (gross tons)[p]	.....	.....	68,324	688,831	.....
Exports of scrap (gross tons)[p]	.....	.....	104,961	1,902,429	.....
British Production:					
British pig iron production (gross tons)[r]	643,100	670,300	525,100	5,862,700	7,010,200
British steel ingot production (gross tons)[r]	1,001,300	1,060,500	903,300	9,030,900	10,679,800
Non-Ferrous Metals:					
Lead production (net tons)[s]	.....	42,156	40,369	379,744	.....
Lead shipments (net tons)[s]	.....	59,210	43,035	391,123	.....
Zinc production (net tons)[t]	45,742	46,297	37,469	390,949	477,221
Zinc shipments (net tons)[t]	57,107	54,035	48,172	423,658	593,452
Deliveries of tin (gross tons)[v]	5,345	6,005	4,035	53,750	77,075

†Three months' average. *Revised.

Source of figures: [a] Lake Superior Iron Ore Association; [b] Bureau of Mines; [c] THE IRON AGE; [d] Bureau of the Census; [e] American Iron and Steel Institute; [f] National Association of Flat-Rolled Steel Manufacturers; [g] American Institute of Steel Construction; [h] United States Steel Corp.; [i] United States Engineer, Pittsburgh; [k] When preliminary, from Automobile Manufacturers Association—Final figures from Bureau of Census; [l] F. W. Dodge Corp.; [m] *Railway Age;* [n] National Machine Tool Builders Association; [o] Foundry Equipment Manufacturers Association; [p] Department of Commerce; [r] British Iron and Steel Federation; [s] American Bureau of Metal Statistics; [t] American Zinc Institute, Inc.; [v] New York Commodities Exchange.

Weekly Index of Rate Activity in Capital Goods, Adjusted for Seasonal Variation, 1925-27 Average = 100

THE IRON AGE Weekly Index Numbers of Capital Goods Activity

(1925-27 Average = 100)

Last week	100.1	Same week 1933	53.5
Preceding week	97.5	Same week 1932	41.6
Same week last month	89.0	Same week 1931	52.9
Same week 1935	82.5	Same week 1930	73.7
Same week 1934	56.0	Same week 1929	92.2

THE IRON AGE's business curve for durable goods industries passed the 100 mark last week to reach its highest level in six and a half years. After adjustment of the separate series for seasonal change, the activity composite rose 2.6 points to 100.1 per cent of the 1925-27 average, thus indicating a return to normal as based on a representative three-year period.

The index's approximate 100 per cent level last week exceeded all corresponding weeks for earlier years since records have been kept, or back through 1929 when it stood at 92.2 per cent. Comparisons are given in the accompanying table.

Except for one interruption, the index has steadily continued to rise week by week since the end of September, and this unusual growth has been appreciably influenced by contra-seasonal strength in steel mill operations. The separate index of this activity stood last week at fractionally over 101 per cent of average weekly production during 1929, the banner year. Other factors have also materially benefited the general upward trend, particularly the automobile and lumber volume series. The index of industrial conditions for the Pittsburgh area has recently been unusually strong.

Components of The Index (1) Steel Ingot Production Rate, from THE IRON AGE; (2) Automobile Production, from Cram's Reports, Inc.; (3) Revenue Freight Carloadings of Forest Products, from Association of American Railroads; (4) Industrial Productive Activity in Pittsburgh District from Bureau of Business Research of University of Pittsburgh; (5) Heavy Construction Contract Awards, from *Engineering News-Record.*

World Bauxite Output Increased in 1935

WORLD production of bauxite, the basic material in the manufacture of aluminum, registered an appreciable increase in 1935 compared with the preceding year, according to a report to the Commerce Department. Aggregate world production in 1935 totaled 1,747,200 tons compared with 1,251,400 tons in 1934 and 1,867,200 tons in 1929.

France, the world's largest source of bauxite, accounted for 505,000 tons in 1935, Hungary was second with 250,000 tons and the United States ranked third with a production totaling 237,000 tons. Other important producers with the 1935 totals were: Yugoslavia, 190,100 tons; Italy, 170,000 tons; Soviet Russia, 130,000 tons; British India, 113,300 tons; and Dutch Guiana, 110,000 tons.

Out of the total 1935 production of 1,747,200 tons of bauxite, 1,000,000 tons was absorbed in the manufacture of aluminum, the remainder being employed in the production of aluminum cement, aluminum salts, abrasives and various refractory products.

WASHINGTON . . . . . .

o o o

By L. W. MOFFETT
Resident Washington Editor, The Iron Age

o o o

. . . Acting Comptroller General overrules Secretary Ickes on placing of steel orders when identical bids are received.

o o o

. . . Awards must be made by lot and not by giving them to mill farthest from point of delivery.

o o o

. . . Federal Trade Commission expected to get behind anti-basing point bill.

o o o

. . . Hearings of NLRB complaint against Carnegie-Illinois Steel Corp. begun; continuance of railroad emergency freight charges denied by ICC.

WASHINGTON, Dec. 22.—When Secretary of the Interior Ickes received identical bids on materials for Federal projects it was his policy to make the award to the plant located farthest from the delivery point. Or he told the White House about it. And once when he did so the White House told the Federal Trade Commission about it. The Federal Trade Commission checked on the situation. It involved what Secretary Ickes called "collusive bidding" on steel piling. The FTC, ever eager to strike at the basing point system in the steel industry, made a lengthy report back to the President, took the same point of view as that of Secretary Ickes, laying the blame on the basing point system. It recommended that the case be sent by the President to the Department of Justice. The President immediately referred the complaints to the Department of Justice "for appropriate action." That was last June. A report on the case back to the President is expected to be made soon by the department.

Now the matter of so-called identical bidding has been passed upon by Acting Comptroller General Elliott. In a ruling last week he said that when several identical bids are received, and there is no violation of the anti-trust laws, the successful bidder must be determined by lot. So, hereafter, Mr. Ickes must make awards under a system of drawings, just as the Navy Department and other Government branches long have done. Unless the successful bidder happens to produce at a point farthest removed from the site of the job, Secretary Ickes cannot give him the business. This policy was based on the desire to give the award, in the case of identical bids, so that the plant getting it would receive the lowest net return possible. That is to say, to receive the base price with the greatest minus possible. Apparently some satisfaction was derived from this practice. And also it was supposed to be a boost for the railroads, since a portion of their carrying charges had to be absorbed by the successful bidder.

May Award to Nearest Bidder

But Mr. Elliott did not stop at holding against this policy. Instead he pointed to an opposite policy, saying that his office has held that in view of the element of time involved in shipping to destination, "the administrative contracting officer may award the contract to the bidder in the locality where the work is to be performed, or the material is to be used, so as to effect any possible savings of time." It probably is a safe guess, however, that if delivered prices quoted are identical, Mr. Ickes won't heed this suggestion unless there actually is pressure for quick delivery. Rather, he likely will do the next thing and have the successful bidder drawn from the hat or whatever other receptacle is used to carry the names of the bidders.

Recently, in an address before the Council for Industrial Progress, Assistant Attorney General John Dickinson said that identical bids in themselves do not constitute a basis for action under the anti-trust laws. Proof of "concerted action" must be given. The FTC did charge "concerted action" It also said the sheet piling bids were identical because bidders "continued to formulate delivered prices under the basing point system as set out in the NRA code." Which was and is a somewhat jarring note. It reflected the ill-concealed dislike by the FTC of the NRA and still stands as one of its many rebukes to NRA, which Major Berry's Council for Industrial Progress, together with other groups, is trying to revive, dressed, if possible, in constitutional habiliments. Or if that is not possible, then the major says he favors a constitutional amendment such as would bring about resurrection and give legitimacy to the old Blue Eagle. The major's denial that he wants to revive NRA doesn't square with his activities. Parenthetically, however, the long odds are against a constitutinal amendment and Major Berry is thoroughly aware of the fact. His remarks about resorting to a constitutional amendment, like his remarks about resigning as Coordinator for Industry, were simply made for effect and are not to be taken seriously. The more or less persuasive major has a well-developed sense of strategy and a fairly well-developed sense of dramatics. In the latter respect, of

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New bulletin just off the press sent on request.

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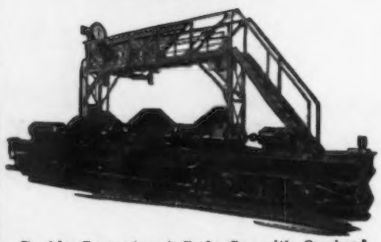

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course, the major is greatly outranked by one of his colleagues, John L. Lewis, if one cares for his sort of dramatics.

Comptroller Explains Policy

To get back to the ruling on identical bidding. It was the outgrowth of complaints made by the Colorado Fuel & Iron Co. and the Rocky Mountain Architects & Builders' Service with relation to recent contracts for reclamation projects in the Rocky Mountain area. Passing upon a statement by Secretary Ickes that the policy of awarding contracts to the "farthest bidder" was adopted because of the "persistent failure of bidders to submit bids on a competitive basis," Comptroller Elliott said:

"Sec. 3709, Revised Statutes, requires contracts to be awarded to the lowest responsible bidder, and if there be received bids, all in identical amounts and no particular advantage to the United States in selecting any one of the bids, there should be followed the procedure of awarding the contract by lot."

And Mr. Elliott wound up by saying that hereafter, when the time element is not important, the Interior Department would be expected to award contracts by lot. When the time element is important the plain inference was that the Interior Department will be expected to award the contract to the bidder in the locality nearest the point of delivery. Just as Assistant Attorney General Dickinson, in charge of anti-trust cases, had in effect told Berry's council, Mr. Elliott said that there is sufficient power under anti-trust laws to punish bidders who entered identical bids in order to stop competition.

Certainly Mr. Dickinson did not attack the system on which prices are based. Concert of action, he said, must be proven. The FTC, of course, not only alleged collusive bidding but hitting at the basing point system generally declared "that the entire price structure of the iron and steel industry was the result of an elaborate concert of action among supposedly competing interests and that other important industries were similarly organized."

FTC May Push Anti-Basing Point Bill Again

And, if the FTC has its way, it will again push for passage of the Wheeler - Utterback anti - basing point bill as it did at the last session when the bill was the subject of hearing before Senator Wheeler's Committee on Interstate Commerce. Mr. Ickes also was called before the committee to air his grievances against identical bidding. Hearing these witnesses, one would gather there is no competition in industries using the basing point system, that there is no such thing as a basing point price-minus, that it is always basing point-plus. A strange contention. They must have overlooked the records, as for instance, the recent torrent of red, notably the 1930-1934 period with only a thin streak of black beginning to show in 1935. Even at that Mr. Dickinson said rigidity and uniformity of prices are not grounds for illegality.

And inasmuch as the FTC indulges in the criticism that steel sheet piling bids were identical because the bidders had continued to "formulate prices under the basing point system" as set out in the NRA code, why doesn't it direct its fire at the source of the codes? Why shoot only at industries using the basing point system? The President endorsed and signed the NRA act. And the codes were framed under that act. Nor could any code become effective unless approved by the Administration.

The FTC of course attacked the basing point system long before code days. That is very clearly in mind. But inasmuch as it blames the code for the present basing point system it should have in all fairness criticised the source of the codes—the Administration. For no matter how or by whom the codes were drafted, the Administration was their source. It sponsored and approved them. Passing by the principles of the basing point system of codes, these were under attack by the FTC. It has never hesitated to attack business interests in a spirit of outraged righteousness. Why hold out in its attack on the source of codes? Such criticism would be refreshingly frank.

Berry Program Confused

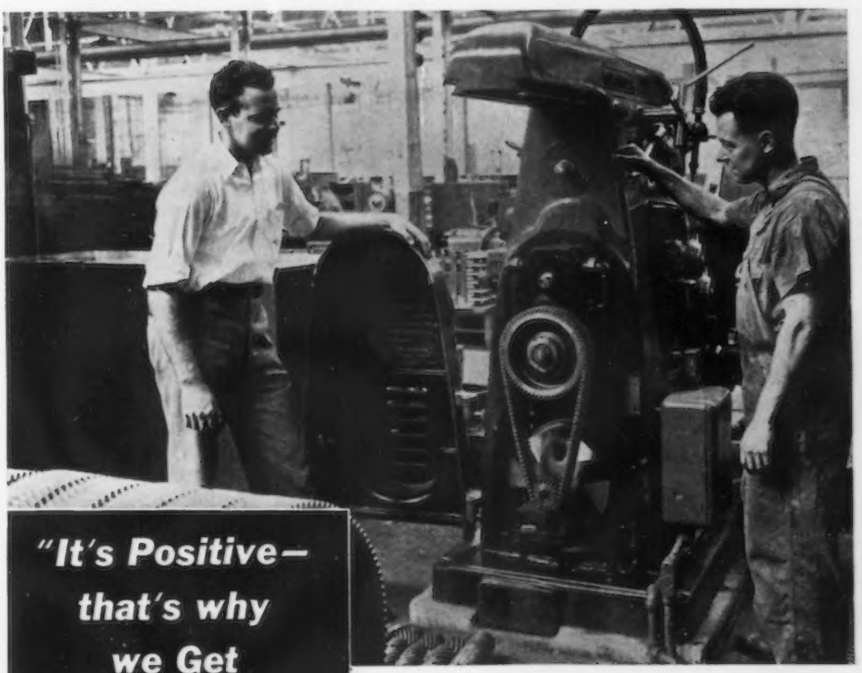
The Berry council program of confusion and contradiction would set up a Fair Trade act—an NRA that in fact would be administered by the FTC. At least, the council's committee suggests that an administrative body should be constituted either out of the FTC "or otherwise," which would seem to point to chances for FTC to OKeh voluntary agreements between management and labor—that is, codes. With exemption from liability under the anti-trust laws.

The Berry committee recommendations are a hodge-podge. And the committee of the council selected to "coordinate the coordinated contradictions" has a task on its hands that makes the

task of Santa Claus look like that of a glorified messenger boy by comparison. The recommendations would limit hours of work. They oppose control of production except in times of "emergency," and an "emergency" too often is what a bureaucrat wants it to be. The voluntary trade agreements between labor and management provides exemption from anti-trust prosecution. At the same time it is proposed to tighten the anti-trust laws. Much was heard about the necessity of efficient business management. There is a widespread view that the loans would simply subsidize inefficiency. But subsidy of everything that carries political power has become so commonplace that it has almost become the exception rather than the rule. Secretary Wallace wants to go further on the rampage of subsidizing agriculture and of extending it to farm tenancy. These are but a few of the activities that give a hollow sound to talk of economy in government.

Balancing the Budget

It is no wonder that there is Administration hedging on the matter of balancing the budget. The country now is told it might be balanced in a year or two. It is given no definite promise. And it is just as well it is not, seeing that Government debts continue to mount till now an all-time high of more than $34,000,000,000 has been obligated. Outgo still greatly exceeds income despite the increase in taxes due to rising business which is the occasion of so much ballyhoo in Washington. At that the receipts for the fiscal year 1937 likely will not run to the high estimate of $5,660,000,000, as has been calculated. Hence the 1937 estimated deficit of $957,000,000 as fixed by the President in September, exclusive of debt retirement, bonus, and unbudgeted relief appropriations of at least $500,000,000 likely will be too small. Department after department, bureau after bureau, board after board, new and old, some loaded with idlers whose chief function is to eat taxes and heckle industry, have piled up on the country a gigantic bureaucracy whose lust for power is never gratified. They are asking for more money and for more power. And their voices probably will be mightier than the weak voices about decentralization and reorganization of Government. History shows that once the Government adds to its plant it seldom can be pried loose. Rather it pyramids the job for the benefit of job holders—and job dispensers. "As long as we keep adding agencies and functions," said Representative Buchanan, outspoken chairman of the House Committee on Appropriations, "we've got to appropriate for them and we can't cut down." This despite White House talk of scaling appropriations. The realistic Mr. Buchanan sees only a dim chance that the "ordinary" budget will be balanced during the coming fiscal year—1938—to say nothing of the "extraordinary" budget. And Speaker Bankhead has a faint hope to "get within sight of a balanced budget within the next two years." Chairman Harrison of the Senate Committee on Finance and Chairman Doughton of the House Committee on Ways and Means talked taxes with the President. Senator Harrison gave it as his "firm conviction" that there will be no new taxes. And, as if he were announcing a great Christmas present for the nation he hinted thinly at the possibility of eliminating some



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minor nuisance taxes, if that means anything, which it probably does not. There is a real sense of appropriateness in his reference to "minor" nuisance taxes, seeing that there are so many kinds of nuisance taxes required to support the vast and growing bureaucracy. And seeing that so many have acquired the idea that the Uncle Sam is a year-'round Santa Claus who needs only to be asked and he will bring the presents to the innumerable askers. One tax that is not going to be changed at the forthcoming session of Congress at least, according to Harrison, is the undivided profits tax, for Harrison said the President stands firm for the principle of this sort of taxation. Hopeful, it is assumed, that another depression which would call for use of industry's surplus funds, is not in sight.

Emergency Freight Tariffs Cancelled, Railroads to Urge Basic Rate Changes

WASHINGTON, Dec. 21.—The Interstate Commerce Commission, having denied in a decision last Saturday the petition of railroads to continue existing emergency charges after Dec. 31, the carriers are now preparing to press their petition for readjustment of the basic rate structure. Hearing on the latter petition will begin on Jan. 6. Carriers estimate that if this petition is granted they will salvage approximately $50,000,000 a year in revenue which compares with estimated returns of $10,000,000 a month from the existing surcharges, based on the current volume of traffic.

The commission voted 9 to 2 against continuing the surcharges. The majority held that the emergency which the commission undertook to meet in its original decision, March, 1935, granting the surcharges, does not exist now. In a decision of June 9, 1936, the commission extended the surcharges to the end of the year. It declared that a continuing revival of industry appears likely to result in further increase in traffic and that no general sharp increase in operating expenses is immediately in prospect.

"Shippers and receivers of freight have every reason to expect the elimination of the emergency charges at the end of this year," the majority said, "and an extension, in the light of our previous expressions, would amount almost to a breach of faith, under existing conditions."

By some this observation was held to indicate that the majority may also take an unfavorable attitude toward the petition for readjustment of the basic freight rate structure.

Dissenting opinions were rendered by Commissioners Mahaffie, chairman of the commission, and McManamy. Chairman Mahaffie declared that improvement in railroad traffic and earnings has not yet gone far enough to permit the railroads to restore deferred maintenance incurred during the depression period, nor to enable them to acquire the new equipment and facilities necessary to handle safely and promptly any considerable additional traffic. To insure the necessary prompt and efficient railroad service, he said that the carriers must have earnings sufficient not only to adequately maintain their properties, but to furnish a basis for credit. He declared that the 2.36 per cent now being earned on property investment is not sufficient to make possible the rehabilitation and improvement of the railroad plant that is required to meet the demands of commerce. He added that the present emergency charges have not hurt business, but are helping the carriers.

Commissioner McManamy said that the June 9 decision, saying that the emergency would disappear on Dec. 31, could be only an expression of hope which was not then justified and has not since been realized.

The principal protests against the continuance of the surcharges came from the coal industry. There was also considerable objection from ore and coke interests as well as from numerous other shipping groups. The majority said that resistance to the emergency charges was more pronounced and widespread than it was at the time of either their original establishment or later extension. At present, it was stated, shippers appear to be substantially unanimous in the view that, whatever the original justification for the emergency charges may have been, the emergency which they were designed to meet has passed rapidly or is rapidly passing, and that further continuance pending the disposition of the carriers' proposal to make changes of a permanent nature in their rate structure is both unjustified as an emergency matter and would distinctly increase the diversion of traffic from the rails.

NLRB Opens Hearing in Complaint Against Carnegie-Illinois Steel

WASHINGTON, Dec. 21. — With Washington as its setting and the steel and automotive industries as the chief objects of attack, the Committee for Industrial Organization, headed by John L. Lewis, staged a series of activities last week which were evidently designed to impress Government and industry. Undoubtedly also, the committee, playing for nation-wide publicity, had as one of its important objectives, the purpose of flaunting its claimed strength as a rebel organization in the face of officials of the American Federation of Labor, its bitter rivals.

Whatever may have been the general impression growing out of its gestures, looking to the disruption of so-called company unions and the industrial unionization of mass industries, the CIO met with a challenge from the Carnegie-Illinois Steel Corp. It was issued by L. H. Burnett, Pittsburgh, vice-president of the steel company, at a press conference last Thursday, in connection with a three-day hearing, ended Saturday, before the National Labor Relations Board.

The hearing, the first of a series, was based on an NLRB complaint issued at the instance of the CIO's Steel Workers' Organization Committee, and charges that the United States Steel Corp. and the Carnegie-Illinois Steel Corp. have interfered with self-organization of employees in 21 plants of the Carnegie-Illinois company. The star witness for SWOC was Elmer J. Maloy, stripper crane operator at the Carnegie - Illinois Duquesne, Pa., plant. Philip Murray, head of the SWOC, led the supporting cast.

Mr. Burnett declared that it is the intention of the Carnegie-Illinois Steel Corp. "to support determinedly its three-year-old plan of employee representation." Mr. Burnett as one of its counsel denied the right of the board to

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interfere with the company's employees dealing under the Wagner-Connery labor act.

Serves Notice on General Motors

In connection with the automotive situation, Lewis, after a conference with representatives of the United Automobile Workers, a CIO affiliate, served notice on the General Motors Corp., that an immediate demand would be made upon it for an agreement with the UAW as a collective bargaining unit. This threat of a strike, in the absence of such an agreement, was the most direct yet made by Lewis as he proceeds with like moves in the major industries of the country. Manifestly, labor trouble in the automotive industry would react against steel and other supplying industries. Participating in the conference Lewis held with respect to the automotive unionization campaign were officials of Flat Glass Workers Union, 85 per cent of whom Lewis said were then on strike. He declared he would give full support toward a complete tieup of the industry.

This move toward organization of the flat glass workers reflects an interesting strategy that the CIO has adopted. Its purpose apparently is to tieup "feeder" units of the major industries as a means of crippling or paralyzing the latter which might not themselves be suffering from strikes. Demands made by the CIO unionized glass workers call for a preferential shop and a check-off system. Further extending his attacks, Lewis has announced an additional assessment of $1 per month on the United Mine Workers Union, of which he is president. The plan seems to be the building up of a "war chest" in anticipation of trouble in negotiating new wage agreements with the coal industry before existing contracts expire April 1 and of building up funds for use in the campaign to unionize steel and other large industries. Conceivably, too, some of the money will go toward the contribution of $479,000 the United Mine Workers made in the campaign for the reelection of President Roosevelt.

SWOC Asks to Be Bargaining Agency

The three-day hearing before the NLRB in the Carnegie-Illinois case brought from witnesses for the SWOC mere reiteration of old charges which have been made repeatedly ever since the CIO was organized. It did, however, bring before the board the first formal record in the SWOC move to have itself declared the collective bargaining unit in the steel industry. Lewis was present when the hearings were begun. Supported by Murray and other SWOC representatives, Maloy in elaborate recital before a sympathetic board, charged that the Carnegie-Illinois representation plan is illegal, one claim made being the plan is financed by the company in violation of the Labor Act. Discrimination against SWOC workers was charged and contention was made that the employee representation plan does not permit negotiation of wage agreements by employees. Maloy reluctantly admitted that the plan did afford "some advantage" to employees. When Murray was asked what the real objective of the SWOC drive is, he replied that it is hoped to avoid strikes. Instead of bringing about a strike in the steel industry, he added, it is the plan of the SWOC to complete its organization and then ask officials of the steel companies to meet for the purpose of negotiating wage agreements.

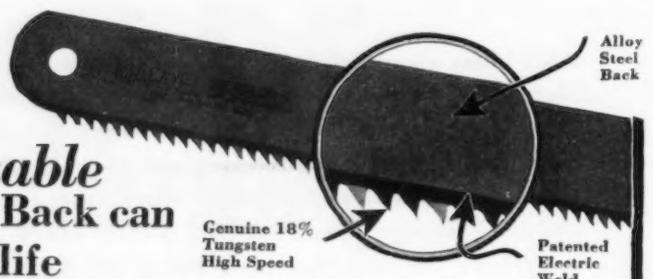
Motions made before the board by Nathan L. Miller, general counsel for the United States Steel Corp., were rapidly denied by Chairman J. Warren Madden of the NLRB. Mr. Miller had asked that the complaint be dismissed as it applied to the United States Steel Corp., on the ground that it is not a party to the employee representation agreement. Pointing out that he had not had time to prepare a reply, Warren Beye, counsel for Carnegie-Illinois, asked that the hearing be postponed until Jan. 28. Judge Burnett said his associates, Mr. Beye and John J. Heard, in attacking the constitutionality of the Labor Act, also expressed the opinion that results of previous similar attacks should be decided before the accusations might rightfully be aired before the board.

After the motions were denied, it was arranged that the next hearing will begin Jan. 11 with the appearance of additional SWOC witnesses. Answers of the United States Steel Corp. and the Carnegie-Illinois Company are to be filed by Jan. 9. At the conclusion of the evidence of SWOC, with perhaps a week intervening, the respondents were given the right to present rebutting evidence. It was stated that many employees are anxious to testify in favor of the employee representation plan.

After the morning session of the first day's hearing last week, counsel for both the United States Steel Corp. and the Carnegie-Illinois Steel Corp., withdrew from the proceeding.

Carnegie-Illinois States Its Position

In setting forth the position of the Cargegie-Illinois Steel Corp., Judge Burnett said that as a party to a contract with its employees, the company "will respect its obligation, through every possible lawful effort to maintain the legality of the employee representation



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plans and continue to deal with its employees thereunder."

Judge Burnett outlined in some detail the workings of the plan since their inception in June, 1933, and gave specific reasons for opposing any attempts to render them ineffective or inoperative.

"The employee representation plans have proved the best ones devised for the settlement of all questions between employees and management regarding wages, hours, working conditions and such subjects," said Mr. Burnett.

"Since the Carnegie-Illinois Steel Corp. has agreed with its employees that the plans shall remain in full force and effect until the employees decide to terminate them, the company will respect its obligation and make every possible effort to maintain the legality of the plans and continue to deal with its employees thereunder."

In answer to the accusations of company domination, coercion and intimidation of employees, Mr. Burnett said:

"The representatives have shown clearly by their independent attitude in making requests and demands upon the company that they are entirely free of any such intimidation, coercion or domination in representing their constituents.

"Their demands have been made openly and, solely upon the initiative of the representatives, have been printed in the public press, which indicates that the representatives know that they are free to act for their constituents in accordance with their honest beliefs."

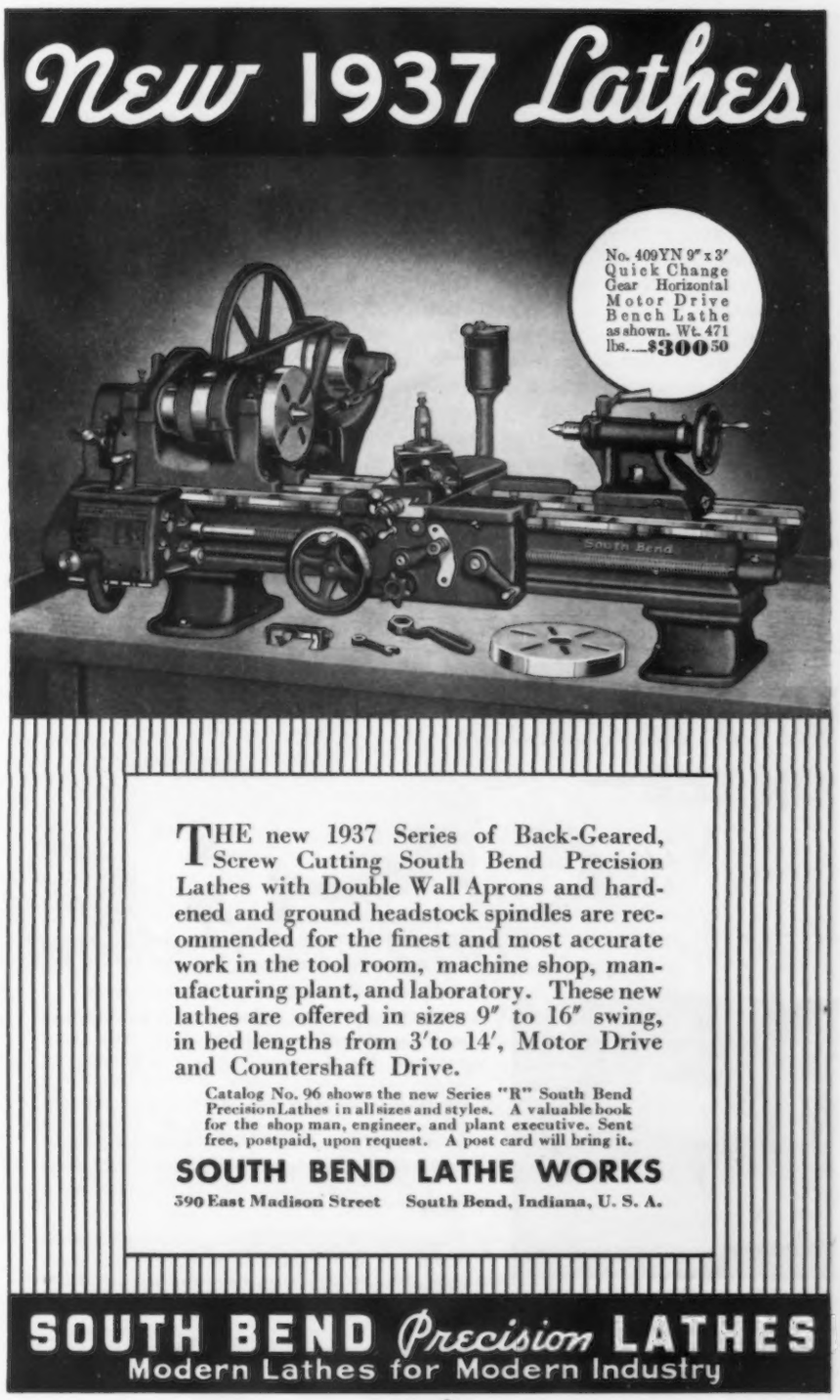
Mr. Burnett emphasized that the Carnegie-Illinois Steel Corp. already is proceeding, and will continue to proceed most expeditiously, to prepare to meet all the accusations and establish the fact that the employee representation plans have operated as a suitable vehicle for collective bargaining and to promote harmonious relations between the employees and management in the utter absence of domination, intimidation or coercion.

Mr. Burnett pointed out further that the elected representatives of the Carnegie-Illinois Steel Corp. employees are not parties to the board's current proceedings and have not received any notice that the validity of their employee representation plans are being attacked. He said it was the company's belief that these men should receive due notice and be given an opportunity to appear and participate in the proceedings.

Since the introduction of the employee representation plans more than 90 per cent of the Carnegie-Illinois employees have participated in them by casting their ballots for representatives. When in February, 1934, a number of amendments recommended by the elected representatives were adopted, more than 90 per cent of the company's employees voted upon and indorsed the plans as amended.

During their operation, the plans have proved to be of real benefit and a great satisfaction to the employees, Mr. Burnett said. Of 4204 requests on related subjects such as wage adjustments, better working conditions, etc., presented by the elected representatives up to July 1, 1936, in Carnegie-Illinois plants 2514 were acted upon favorably to the men, 218 were compromised and 1090 were denied. Cases withdrawn totaled 229 and only 153 were left pending on that date, when last a compilation was

(CONTINUED ON PAGE 71)



THE new 1937 Series of Back-Geared, Screw Cutting South Bend Precision Lathes with Double Wall Aprons and hardened and ground headstock spindles are recommended for the finest and most accurate work in the tool room, machine shop, manufacturing plant, and laboratory. These new lathes are offered in sizes 9" to 16" swing, in bed lengths from 3' to 14', Motor Drive and Countershaft Drive.

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Modern Lathes for Modern Industry

Random Thoughts of an Idle Steel Man

(CONTINUED FROM PAGE 23)

(6) Increased porosity of coke.

(7) The blast furnace practice reflected a reduction of 5 to 8 per cent in fuel consumption, a 5 to 10 per cent reduction in flux with a subsequent reduction of 7 to 12 per cent in slag volume, and a 5 to 8 per cent increase in production of lower sulphur pig iron.

In the face of these results we may expect to find an increasing use of washed coal. It would seem desirable in those cases in which satisfactory results can be obtained, to use the air method, even if used in treating only a larger fraction of the mine production. The freight savings due to moisture elimination, difficulties of winter unloading, and the heat saving in coking are factors of importance. Since it requires nearly double the energy to vaporize the same weight of water as that needed to coke an equal weight of coal, in addition to the increased load thrown upon the condensing system of the by-product plant, these avoidable wastes merit attention.

In the case of integrated plants it may be found desirable to dedust the mine coal, regardless of the method of beneficiation. The early removal of the dust will prevent the excessive development of sludge with its serious problems of recovery and drying, also the uniform distribution of the slurry in the washed coal. Irregular moisture content of oven coal produces spotty or irregular coking results. Washer practice would also be improved due to the less rapid build up in the specific gravity of the re-circulated wash water. The recovery from the de-duster may be more advantageously used as fuel, especially where it can displace blast furnace gas at furnace boilers, as the furnace gas can be more economically used elsewhere.

In the washing of coal for metallurgical purposes there are two objectives: the first is that of removing the greatest amount of impurities within commercial limits, while the second is that of producing a *uniform* product, even though uniformity is secured with a slightly higher ash content. Variations in coke ash have a greater significance than a similar variation in ore, not only is the basicity of the furnace slag affected but also the more or less available fixed carbon content, which directly affects hearth temperatures, thereby altering silicon and sulphur content in the pig iron. There is considerable evidence indicating a correlation between coke ash variations and the analysis of the iron, pointing to the great importance of careful and uniform blending of coals at the coke plant if precision of operation is to be maintained at the blast furnace.

Another heat loss at the coke plant is that of oven radiation requiring the use of extra gas in maintaining temperature. Insulation of the ovens and doors would reduce this waste, improve working conditions, and, in case of banking the plant, greatly reduce gas requirements for the maintenance of the necessary oven temperature.

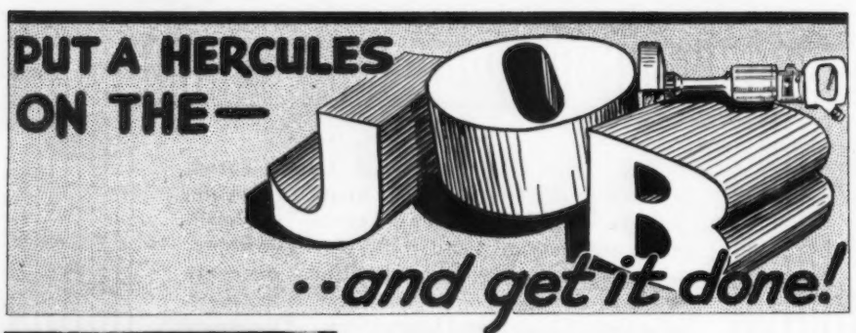
[TO BE CONCLUDED]

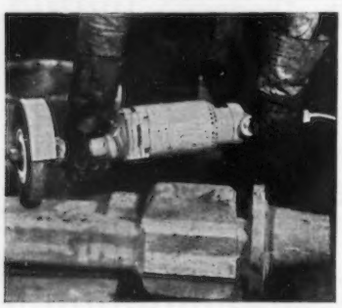
October Shows Employment Gain

THE total number of unemployed workers in October, 1936, was 8,673,000, according to estimates of the National Industrial Conference Board. This figure represents a decrease of 309,000, or 3.4 per cent, from the revised estimate for the preceding month, and a decrease of 1,999,000, or 18.7 per cent, from October, 1935.

Employment in all types of enterprise in the United States in October, 1936, was 44,100,000 workers, an increase of 360,000 over September, and an increase of 6.3 per cent or 2,605,000 over October, 1935. From September to October, increases in employment, by industrial groups, were: manufacturing, 185,000; trade, distribution and finance, 90,000; service, 54,000; mining, 17,000; transportation, 12,000; public utilities, 4000; and agriculture, 4000. Employment in the construction industries decreased 17,000.

Meanwhile the cost of living of wage earners, as estimated by the board, rose 0.1 per cent from October to November. Although food prices declined in this period, rents, clothing, fuel and light, and sundries all increased slightly.





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...OBITUARY...

HENRY O. VAN EWEYK, founder and president of the Milwaukee Brass Mfg. Co., Milwaukee, died of a heart attack on Dec. 6, aged 68 years. He was born in Milwaukee. His son, George W., is vice-president, and another son, William F., is secretary and treasurer of the corporation.

❖ ❖ ❖

WILLIAM CAMPBELL, professor of metallurgy at Columbia University since 1914, died of heart attack at his home in New York on Dec. 16. He was born in England 60 years ago and held degrees from King's College, London, and Durham University. He came to the United States in 1902 to teach at Columbia. He became an instructor in metallurgy two years later, adjunct professor in 1907, then successively associate professor and full professor in 1914. He was made the first Howe Professor of Metallurgy in 1924, a chair created in honor of the late Henry M. Howe. In the last year of the World War, he was metallurgist at the Brooklyn Navy Yard. He held the rank of lieutenant commander in the Naval Reserve in 1918 and commander from 1919 to 1929. Prof. Campbell was active in public service and held a number of important posts. He was a member of the committee on alloy research of the National Research Council, and of the advisory committee of the United States Bureau of Standards. During his career he edited the *Columbia School of Mines Quarterly* and also the *International Journal of Metallography* and the *Journal of Industrial Engineering Chemistry*. He was also a member of a number of scientific societies, including the American Iron and Steel Institute and the American Institute of Mining and Metallurgical Engineers.

❖ ❖ ❖

CLAUS GREVE, founder of the Cleveland Pneumatic Tool Co. and the Champion Machine Forging Co., Cleveland, and president of the former company until he was succeeded two years ago by his son, L. W. Greve, died Dec. 20, aged 82 years. He was also one of the founders of the Acme Machinery Co., Cleveland.

❖ ❖ ❖

ALBERT J. HANSON, formerly designing engineer for the American Electric Furnace Co., and also an inventor of a hydraulic pump, died on Dec. 16, at his home in Arlington, Mass. He was a native of Maine and was born 51 years ago.

❖ ❖ ❖

RALPH C. ROSE, for the past year general manager of the Moloch Co., Kaukauna, Wis., founder, machinist and manufacturer of heavy duty stoking equipment, died on Dec. 10, aged 45 years. Formerly he was sales manager of the Stroh Die Molded Casting Co., Milwaukee.

ERNST ANHEUSER, pioneer industrialist of Racine, Wis., died on Dec. 9, aged 74 years. He was born in Germany and came to America in 1894, settling in Racine. In 1901 he organized the Racine File Co. and later the Anheuser Mfg. Co., manufacturing mechanics' tools. His sons, Ernst, Jr., and Alfred, are president and vice-president, respectively, of the M. J. Skubal Co., Milwaukee, specializing in metal welding.

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A manufacturer who brings the vigor of mountain air to town via air conditioning asked Parish to produce a pressed steel casing for his air conditioning unit. The result is shown here—a splendid Parish execution in cold rolled steel .0375" thick.

A clean-cut stamping like this—whether light gauge or heavy—gives greater sales appeal to any product. Parish has the equipment, laboratory, personnel and skill to do this for you economically. May we help improve *your* product?

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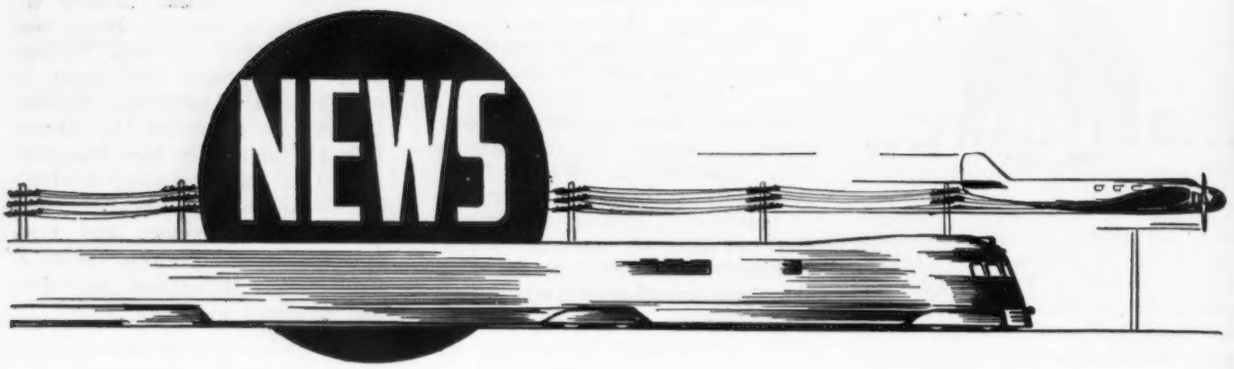

Industry Seeks an Era Of Good Feeling

"PROSPERITY for a nation depends upon productivity and peace. Productivity can be destroyed by internal dissensions, by labor conflicts and by wars. Industry seeks an era of good feeling."

That is industry's declaration of purpose in the code adopted by the National Association of Manufacturers at its annual meeting at the Waldorf-Astoria Hotel, New York, Dec. 9 and 10, following a two-day meeting of the association-sponsored Congress of American Industry.

Representing, as it does, some 60,000 manufacturers, the association has gone upon record as recognizing the beginning of an entirely new era in industry's dealings with Government, the public, labor and itself.

While insisting upon our tried system of individual initiative and free enterprise as the basis of our past and future prosperity and upon regulation, without control, of business by Government, industry now announces its readiness to co-operate to the fullest extent in the creation and maintenance of a higher standard of living for all.

It aims to provide better living, more of the necessities, comforts and luxuries of life, steadier work, more certainty of a job, more security for old age. It points to the facts that employment in reporting industries is now 106 per cent of that of 1929; that wages in industry today are the highest, while weekly hours are the lowest in our history, and that manufacturing income in 1935 was divided in the ratio of one part to dividends and six and one-half parts to wages and salaries.

Obligations of Industry

Colby M. Chester, president both of General Foods Corp. and of the association, put the obligations of industry plainly and thoroughly:

1. Industry must accept its responsibility for the national welfare as being an even higher duty than the successful operation of private business.

2. Industry must continue to fulfill its obligations to the public in making better goods at lower cost, thus raising the standard of living

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Few items in this basket cost more than 10c retail.

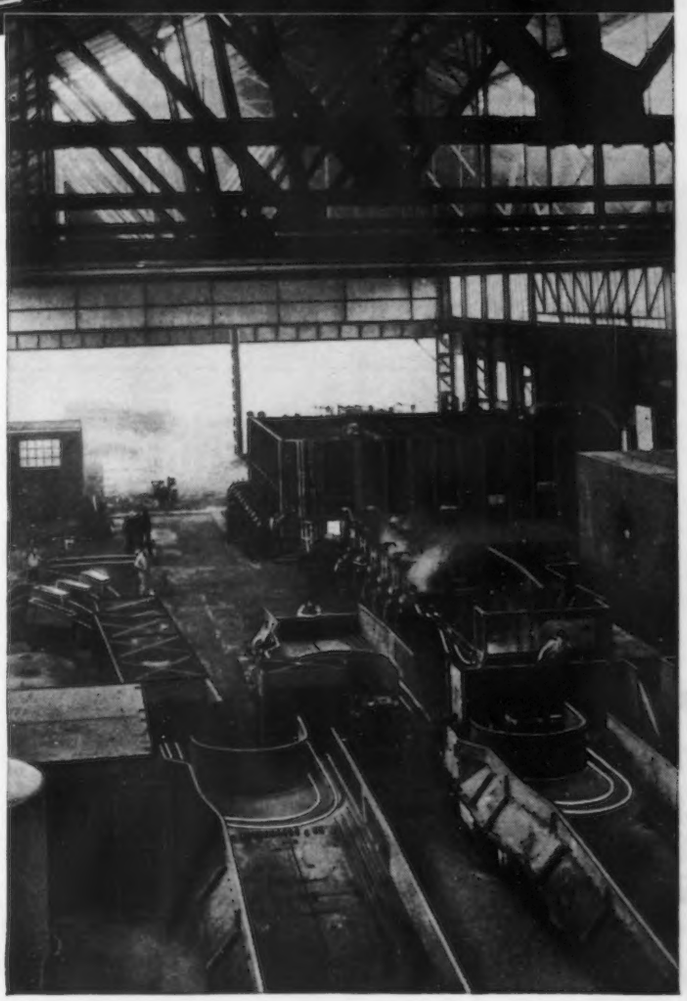
She buys for the American Home, spending her nickels and dimes and quarters where value speaks loudest.

This value is a growing tribute to American ingenuity. For fixed low retail prices have set up standard unit costs that reveal profits only when production continues to flow at uniform speed. This flow starts with the ore, and each step is governed in large measure by the steps preceding.

Can you meet today's demands for uniform rod, strip and merchant shapes—at the price and volume rates which fit such production needs? Not with rolling mills built for the trundling gait of 20-40 years ago. But with Morgan Continuous Rolling Mills you can get and hold this dependable tonnage profitably.

★ ★ ★

Emphatically, yes. For Morgan has built and is building Continuous Rod Rolling Mills in which the first trial bars pass through to the reels, and where double strand can be run the first day. Speeds of 4,000 feet per minute with only a ±.005″ diameter are not only possible—they're *practicable!*



R-14

MORGAN CONSTRUCTION CO.

MORGAN WORCESTER ENGINEERS AND MANUFACTURERS

WORCESTER MASSACHUSETTS

and keeping the door of personal opportunity open.

3. Put every possible employable in manufacturing industry back to work.

4. Keep its own house in order, exposing its policies at all times to public scrutiny.

5. Stand four-square against monopoly.

6. By its actions engender growing confidence on the part of workers.

7. Invite increasing public understanding of industry by telling the facts.

8. See that workers, management and investors, according to their contribution, share fairly in the proceeds of manufacturing.

9. Help to create economic security for all, preserving as well the opportunity for the individual to attain his own *greater* security.

10. Zealously live up to its responsibilities and insist that all other factors of our economic life, including labor organizations, be made equally responsible.

11. Make its cooperation available to government in a constructive manner at all times.

12. Join other business groups in studying the depression in order to minimize or avoid another one.

These aims and obligations were affirmed and amplified by other speakers, leaders of industry, and were included bodily in the code finally adopted. It is the present observer's opinion that these statements and those of the men who addressed the meeting, were far from the glowing platitudes which often mark such gatherings. There was a ring of earnestness about them, coupled, perhaps, with a keen realization of our narrow escape from disaster and a strong determination that it shall not happen again.

Relations With Labor

Industry's relations with labor engaged a considerable part of the attention of the meetings. Charles R. Hook, president of the American Rolling Mill Co., and one of industry's foremost interpreters, delivered one of his wise and understanding addresses on "Employee Relations." In it he told of the success which had crowned his 32 years' efforts to get employer and employee to know and trust each other. American workmen will do the right thing if they understand the various elements surrounding each situation affecting their well-being. The way to do this is to reduce your business policies to writing, see that all employees understand them and that all supervisors adhere to them. Make no mystery of your business, educate your people in it and help them to own a home.

Machine makers and users face a contradictory labor situation at present. With 8,750,000 unemployed, these manufacturers cannot find enough skilled labor, said Warner Seely, of the Warner & Swasey Co. The reason is twofold: 4,434,000, or more than half these unemployed are young people, who have not yet gone to work. Besides this, the drastic expense-cutting of the depression forced the abandonment of the excellent apprentice training courses of many companies.

Apprentice training pays — always has paid—for small as well as large plants, although it might be more economical for the small companies to work out a training plan on a group or community basis. Apprentices may be allocated to each, according to its equipment, work and methods.

Direct negotiations over points at dispute should be initiated voluntarily by employer and employee, not by Government compulsion. This should be reserved for the stubborn or ill-willed, said another speaker. Which is exactly in line with Mr. Hook's advice to work unceasingly for mutual understanding. In fact, that goes for all human relations.

Relations With Government

Industry's relations with Government were discussed most thoroughly by George H. Mead, president of the Mead Corp. and chairman of the Business Advisory Council of the United States Department of Commerce. The membership of the National Association of Manufacturers, he said, holds the responsibility for the lives of more people than any other group in the world. Industry must accept this responsibility and do its duty in a statesmanlike manner, advancing the causes of human happiness and security and preserving the right of free initiative.

Business wants constructive regulation by Government, but not control. It favors economic security, but in a practical form. In order to achieve these wants, business men should consider that there is such a thing as a profession of politics; give part of their time and consideration to the local, State and National Governments, and remember that Government representatives are doing the best that can be done for the prosperity and welfare of the nation and, hence, deserve the aid and advice of all citizens, who are working toward that same end.

John Raymond McCarl, former Comptroller General, laid our late predicament to our own failures in self-government. After the crash following the 1929 spree, we dumped our whole burden into the lap of the Government.

Said he: Our form of govern-

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ment was not planned to provide a central agency to be dominant in the active management of our lives. If we intend to maintain freedom we must assume responsibility, not shirk it. The task is to take back the load dumped on the Government and help put the brakes on public spending. Our budget can be, and must be, brought into balance.

Relations With Public

Industry's relations with the public formed the subject matter of Raymond Moley's address, "Industrial Leadership—1937 Model," and of Arthur Kudner's, "So the Public May Know." Both urged, as did several other speakers, industry's responsibility to the public, not only as consumers, but as parties at interest in the rise and fall of industrial activity. The welfare of the entire public body is affected by the growth of unemployment and the shrinkage of business. Industry therefore owes the public an explanation of its own inside working. Also, by keeping the people informed of conditions which affect prices, industry can dissipate much of the criticism of arbitrariness, which has been, and still is, being directed against it. Ernest T. Weir, chairman, National Steel Corp., made this clear in his address: "Industry Must Speak Constructively," which was published in part in THE IRON AGE of Dec. 10, p. 66.

Precision Instrument Laboratory for N. Y.

THE Ordnance Department of the United States Army will establish a precision gage instrument laboratory early next year at the New York University College, New York. The laboratory, the only one of its kind in the New York area, will be used in the testing of various tools, instruments, mechanisms and other equipment for military purposes. It will be available also to students of engineering, and others, for general research purposes.

Instruments, capable of measurements to the millionth of an inch, will be certified by the United States Bureau of Standards before their installation.

Prof. Carlos de Zafra of the Department of Mechanical Engineering and chief of the gage division of the New York Ordnance District of the United States Army, will be the director of the laboratory.

Mills Fail to Bid on Navy Steel Under Terms of Walsh-Healey Act

WASHINGTON, Dec. 21. — Refusal of industries to bid on Government business under the terms of the Walsh-Healey Act was further emphasized when bids were opened last Friday on 3600 tons of shapes and bars for seven destroyers and 1800 tons of plates for stock for the Navy Department. Steel producers submitted bids only on tonnages involving less than $10,000, which are exempt under the act. Galvanizers, however, offered bids covering requirements for material which would be galvanized under the terms of the act. Copper, rubber and other producers have declined to bid under the provisions of the law.

Meanwhile, the Department of Labor is insisting upon full compliance with the act, and has been supported in its position by R. N. Elliott, Acting Comptroller General. Mr. Elliott, in a ruling last week, upheld regulations prescribed by the Department of Labor under the Walsh-Healey Act. The ruling said that the act is mandatory and that all contracts for purchases by the Government must include prescribed regulations without qualifications. The opinion was in response to a request for a ruling made by the Secretary of Agriculture.

The act calls for an 8-hr. day, and 40-hr. week, with payment of time and one-half for overtime for contracts in excess of $10,000.

War and Navy Department officials have unsuccessfully asked Secretary of Labor Perkins for exemptions under the act.

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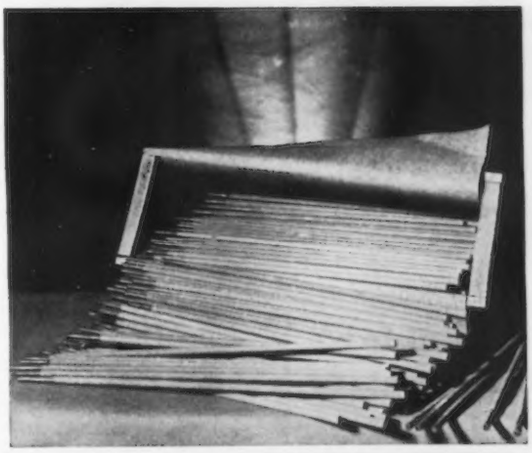

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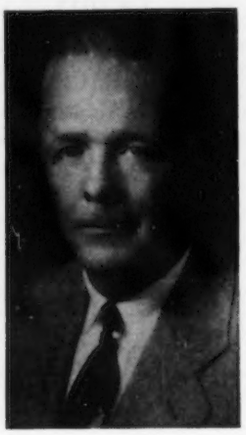

F. H. LOOMIS

W. J. SAMPSON, JR.

Republic Steel Corp. Makes Important Sales Personnel Changes

IMPORTANT changes in the executive staff of the sales department of Republic Steel Corp. have been announced by N. J. Clarke, vice-president in charge of sales.

J. M. Schlendorf, manager of sales, Alloy Division, Massillon, has been appointed assistant vice-president in charge of sales, a newly-created position. His headquarters will be removed from Massillon to Cleveland. *Norman W. Foy*, assistant general manager of sales, has been made general manager of sales; *Frederick H. Loomis*, formerly manager of sales, Sheet and Strip Division, will be assistant general manager of sales; and *William J. Sampson, Jr.*, vice-president of Steel & Tubes, Inc., has been named assistant general manager of sales.

Mr. Schlendorf, the new assistant vice-president in charge of sales, has been with the corporation since its organization in 1930. He joined Central Steel Co., Massillon, in 1917 as vice-president in charge of sales and, when the Central Alloy Steel Corp. was organized in 1926, he remained with the new company in the same position. Previously he was in the sales department of the American Sheet & Tin Plate Co. Mr. Schlendorf has a nation-wide acquaintance among buyers and users of alloy steels.

Mr. Foy, the new general manager of sales, succeeds A. E. Walker, who has just been named executive vice-president of the Pittsburgh Steel Co. Mr. Foy, who was born in Baltimore, started in the steel industry at 16 and has spent his entire business life with steel companies with the exception of one year during the war when he was a first lieutenant in the Engineers. After spending five years in the Baltimore sales office of the Carnegie Steel Co., he joined Republic Iron & Steel Co. in 1918 as a salesman in its Philadelphia office. In succession he was in charge of the company's Philadelphia, Boston, Buffalo, Birmingham, and Chicago offices, and in 1934 went to the general offices of Republic Steel Corp. as assistant general sales manager.

Mr. Loomis, assistant general manager of sales, was graduated from Williams College in 1911, is married and has two boys. Upon graduation, he joined Republic Rubber Co. of Youngstown as a salesman and was next made district sales manager at the Minneapolis office. In 1916 he became associated with the Trumbull Steel Co. and was successively salesman, district sales manager, assistant general manager of sales, and general manager of sales. In 1928, when Trumbull Steel merged with Republic Iron & Steel, he was made

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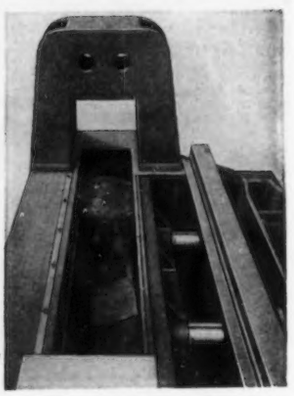

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assistant general manager of sales. Mr. Loomis spent a year and a half in the Navy during the war, starting as an enlisted man and was commissioned an ensign before his resignation.

Mr. Sampson, assistant general manager of sales, was graduated from Yale in 1920, and became associated with Steel & Tubes upon his graduation. He began his active work in the mills and from there was transferred to the sales department. He was later manager of a plant in Toledo then operated by the company, and returned to Cleveland as vice-president.

MARTIN H. SCHMID, formerly assistant manager of sales, alloy steel division, Massillon, has been appointed manager of sales succeeding J. M. Schlendorf. Mr. Schmid was graduated from Lehigh University as a mechanical engineer and has been with Republic Steel Corp. and its predecessor companies since 1909. He started with the United Alloy Steel Co. in Canton as assistant master mechanic, then became metallurgical engineer and assistant manager of sales. In 1926, following the merger with Central Alloys Co., he became assistant manager of the bar department and after that company's merger with Republic Steel Corp., assistant manager of sales of the alloy steel division. Mr. Schmid will have as assistant managers Gordon F. Hess and Clyde E. Roberts.

JOHN V. BURLEY, who has been assistant manager of sales, sheet and strip division, has been appointed manager of sales, of that division. Mr. Burley entered the steel industry in 1917, when he became associated with the Detroit district sales office of the Midvale Steel & Ordnance Co., remaining with Bethlehem Steel Co. after the Midvale - Bethlehem merger in 1925. He then joined the Trumbull Steel Co. in its Detroit district sales office and in 1930 opened a Toledo sales office for Republic Steel Corp. He was moved to the sales headquarters in 1932. J. W. Carpenter will continue as assistant manager of sales, sheet and strip division.

The carbon bar division, with W. F. Vosmer as manager of sales, is being expanded by the following additions: R. W. Hull, formerly assistant district sales manager at Chicago, has been appointed assistant manager of sales, Carbon Bar Division, and will move to Cleveland. Mr. Hull has been with Republic Steel Corp. and predecessor companies for 26 years, having started with the Upson Nut Co. in 1910 as an office boy. He went from there to the billing department, the operating department, and to the Chicago sales office in 1917. Following the merger of Upson Nut with Bourne-Fuller he was made Western sales manager and became assistant district sales manager in Chicago with Republic at the time of the merger. Mr. Hull attended Denison University.

The die roll sales department, which has been moved to Buffalo, with J. S. Langston as manager of sales, is being combined with the carbon bar division in Cleveland and Mr. Langston is appointed assistant manager of sales, carbon bar division. Mr. Langston started in the steel industry as a rougher on a 9-in. mill for the Interstate Iron & Steel Co. in East Chicago, and from there went to the automobile industry. In 1918 he helped build the Central Forge Co., in Detroit, and remained as general superintendent until 1922. From 1922 to 1930 he was general manager of sales for the Witherow Steel Co. at Pittsburgh, going from there to Republic Steel Corp. in charge of die roll sales.

. . PERSONALS . .

M. D. HARBAUGH has been appointed executive officer of the Lake Superior Iron Ore Association, Cleveland, and will look after much of the association's work that heretofore has been handled by its president, R. C. ALLEN. Mr. Harbaugh has been secretary of the Tri-State Zinc and Lead Ore Producers Association, Miami, Okla., having resigned from that position to become affiliated with the Ore association. After his graduation in geology and mining from the University of Wisconsin, he served for three years as member of the faculty in the department of geology during which time he devoted considerable time to research work. On leaving the University in 1927 he was professionally engaged in engineering and mining geology until 1929 when he became secretary of the Zinc and Lead Ore Producers Association.

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WILBERT J. AUSTIN, president, Austin Co., Cleveland; H. H. TIMKEN, JR., executive vice-president, Timken Roller Bearing Co., Canton, and SAM W. EMERSON, president, Sam W. Emerson Co., contractor, Cleveland, have been elected trustees of the Case School of Applied Science, Cleveland.

(CONTINUED ON PAGE 80)

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SWOC Holds Meeting in Pittsburgh And Asks for $5 a Day Minimum

PITTSBURGH, Dec. 21.—At a meeting here today under the auspices of the Steel Workers' Organizing Committee of the Committee for Industrial Organization, approximately 242 pro-Lewis employees from 42 steel companies in the United States condemned the so-called company union, asked for a $5 a day minimum pay, set up a CIO representatives' council, with Elmer J. Maloy as chairman, and urged steel labor to organize.

Representatives who attended the meeting comprise about 10 per cent of the total employee representatives in the steel industry.

The principal speaker at the meeting was Philip Murray, chairman of the SWOC, who claimed the enrollment of 127,000 steel workers in the union drive for members. The SWOC is banking heavily on its publicity program to obtain public support, and is using the National Labor Relations Board hearings as a sounding board.

Homestead Employees Propose Paying Dues

FOLLOWING on the heels of labor hearings at Washington, workers in the Carnegie-Illinois Steel Corp.'s Homestead plant have proposed that its members pay dues to finance the cost of the plan of employee representation. According to Floyd Cooledge, secretary of the Homestead plant wage committee representing 10,000 workers, its constituents have considered for three years the possibility of levying dues on members of the employee representation plan to place complete financial control of the organization with the workmen. The statement in part follows:

"In connection with the case before the National Labor Relations Board in which the Committee for Industrial Organization is charging the Carnegie-Illinois Steel Corp. with dominating the employee representatives because the company paid the expenses of the representatives while engaged in employee business under the plan, I wish to state . . . they (employees) would welcome the opportunity of financially supporting themselves. . . . Employees of my zone feel the negligible amount required for the purpose would be cheap insurance if it would remove the technicality so unfairly used by opponents of the plan to place this stigma of dishonesty upon honest and sincere men. The constituents of other representatives have indicated a similar desire and have expressed the opinion that they have the right to make the necessary correction to remove any question of the legality of their plan of employee representation."

Senate Committee May Hear John Lewis

WASHINGTON, Dec. 21.—The growing tenseness in the labor situation has been accentuated by moves made by the Senate Civil Liberties committee, headed by Senator LaFollette of Wisconsin as they concern the Committee for Industrial Organization in its campaign to organize the steel industry.

The committee made it known that it is giving consideration to the matter of inviting John L. Lewis, chairman of the CIO, to testify when the Senate committee reopens hearings on Jan. 11. It was stated it may also invite Philip Murray, head of the Steel Workers Organization Committee, CIO affiliate, to testify. Significantly, the date will mark reopening of hearings before the National Labor Relations Board in connection with its complaint against the Carnegie-Illinois Steel Corp., issued at the request of the SWOC.

The Senate committee likewise will hold hearings dealing with SWOC charges against the National Steel Corp. Investigators of the committee returned to Washington Monday from Weirton, W. Va., where the plant of the Weirton Steel Corp., subsidiary of the National Steel Corp. is located. The committee also has subpoenaed records of the Tennessee Coal, Iron & Railroad Co. and the Bethlehem Steel Co.

Rust Furnace Co. Gets Steel Plant Orders

RUST FURNACE CO., Pittsburgh, will supply three slab heating furnaces to the Bethlehem Steel Co. for the new strip mill installation at Sparrows Point; three slab heating furnaces to the Republic Steel Corp. at Warren, Ohio, in conjunction with a renovation program at that plant; and three slab heating furnaces for Republic's new strip mill in the Cleveland district.

Rust was recently awarded a contract for 20 permanent type annealing furnaces for installation at the Campbell works of the Youngstown Sheet & Tube Co.

Armco to Build New Blast Furnace

Construction of a new blast furnace of 500 tons daily capacity at the Hamilton Coke & Iron Co. plant at Hamilton, Ohio, has been announced by Calvin Verity, vice-president of the American Rolling Mill Co., of which the Hamilton company is a wholly-owned subsidiary.

The company already operates one furnace of 700 tons daily capacity, which was modernized last summer. The Hamilton Coke & Iron Co. will have a capacity of approximately 1200 tons of pig iron per day when the new stack is completed.

Because increased demands at Armco's Middletown plant absorbed so much of the production of the present stack, it was felt advisable to construct an additional stack to take care of the rapidly growing number of concerns purchasing pig iron from the Hamilton Coke & Iron Co., Mr. Verity stated.

Construction work will be started this month. Erection of the new stack will provide jobs for approximately 150 men for six months, it was estimated.

Braeburn Alloy Steel Makes Improvements

BRAEBURN ALLOY STEEL CORP., Braeburn, Pa., has completed renovation and rebuilding plans started since the flood of March 17, 1936. A three-story office building for executive offices and the metallurgical laboratory has been constructed close to the melting department. A new six-ton Chambersburg hammer was installed and the construction of a new gas-fired billet heating furnace was completed some time ago. Washed out portions of the company's property have been restored to their original level and a new dike and weirs for the protection of the property were recently completed by the Dravo Contracting Co.

H. Winternitz Heads Charles Dreifus Co.

HIRAM WINTERNITZ, Jr., who for some years has been manager of the Philadelphia office of the Charles Dreifus Co., Pittsburgh, will become president on Jan. 1, succeeding Charles Dreifus, who is to be chairman of the board.

H. WINTERNITZ, JR.

CHARLES DREIFUS

Walter S. Gates, who has assisted Mr. Winternitz in the Philadelphia office, will be a vice-president; Charles Dreifus, Jr., who has been in charge of the New York office has been appointed treasurer, succeeding Harry C. Krider, Pittsburgh, who will retire. Mark D. Kuhn continues as vice-president and John W. Todd as secretary and will be in charge of the Pittsburgh office. Headquarters of the company will be situated in the Widener Building, Philadelphia, instead of in Pittsburgh.

One of the oldest companies in the scrap business, having been organized in 1892, the Charles Dreifus Co. has enlarged its business to the point where it is also one of the largest handlers of scrap. In recent years the Philadelphia office, under the management of Mr. Winternitz, has built up a large export business in scrap and in barge shipments to mills and foundries along the Atlantic Seaboard and the Buffalo district. The company now has offices in Pittsburgh, Philadelphia, New York, Worcester and Boston and concentration yards in Brooklyn and Newark.

Removal of the headquarters to Philadelphia is brought about by the increasing volume of Eastern business and in export, making it necessary to maintain a larger staff in Philadelphia.

Port Colborne, Ont., Blast Furnace Sold

THE sale of the Canadian Furnace Co., Ltd., of Port Colborne, Ont., to the Port Colborne Furnace Co., Ltd., for $400,000 became known when the deed was filed last week in the Welland County, Ont., Registry. Controlling interest in the company passes from Frank B. Baird and Harry Yates of Buffalo to the new concern, in which Richard C. Yates, Buffalo, former operating vice-president is said to have the principal interest. Mr. Baird for many years owned the Buffalo Union Furnace Co., which later was sold to the Hanna Furnace Corp. (National Steel Corp.). Port Colborne has one stack, not in blast at present.

November Auto Output 394,890 Units

WASHINGTON, Dec. 21. — Making a gain of 170,262 units, the output of motor vehicles in the United States in November totaled 394,890 compared with 224,628 in October, according to the Bureau of the Census.

Of the November total, 341,456 were passenger cars, which compare with 196,688 in October.

For the 11 months ended November, motor vehicle production in the United States aggregated 3,955,814, of which 3,250,044 were passenger cars.

In the corresponding period of last year production was 3,542,406 of which 2,900,202 were passenger cars. Canadian motor vehicle production in November was 10,812.

The Bureau of Supplies and Accounts, Navy Department, will open bids on Jan. 5 for 163 tons of bar and strip steel for projectile manufacture, the material to be delivered to Baldwin, L. I., N. Y.

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With 51 types always in stock . . . all millings, all sizes from tiny miniatures to great 2-man wrenches . . . there are standard ARMSTRONG WRENCHES readily available to meet any normal industrial requirement. And, for those special demands, calls for special wrenches and special millings, an ample stock of forged wrench blanks is maintained to assure delivery on short notice.

ARMSTRONG Wrenches are quality wrenches drop forged from special analysis high carbon steel, improved in designs, in proportions and balance. They are heat treated, hardened and finely finished in black baked enamel with heads ground bright and plainly marked for size. They are stronger, finer tools, still cost no more than other quality wrenches.

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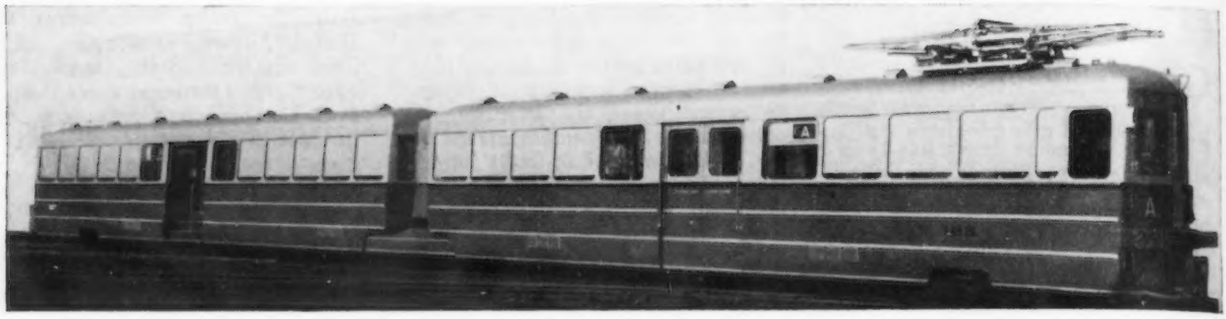

Modern Design and Light Sections Used in San Francisco Street Cars

MODERNIZATION in design and construction of street cars is exemplified in the new cars built by the Bethlehem Steel Co. for use on the new San Francisco-Oakland bridge by the Key System, which operates the transportation facilities across this new structure. The first 12 of these new two-car units, of which there are to be 88, have just been completed at the Harlan plant of Bethlehem at Wilmington, Del., and embody some features that are innovations in this type of railway construction.

Bethlehem's Mayari R steel was used for the body, including skirt, sub-floor and equipment supports, substantially reducing the body weight, thus effecting an important saving in the total weight of each unit in addition to that which was saved by elimination of one truck in each unit by articulation. Another reason Mayari R was used in the body construction is its resistance to corrosion and its ability to combat the atmospheric conditions that the trains will encounter in their 8¼-mile trip across San Francisco Bay.

Aside from unusual construction features, these new cars provide conveniences for passengers that represent a long step forward in passenger transportation over short distances. As smart in appearance as a 1937 automobile, with streamlining, modern heating and ventilating and lighting, rubber insulation against noise and shock and pullman-type springs for easy riding, these cars will embody just about every feature that rapid transit in the new way can provide.

One of the novel features of these cars is their heating and ventilating system which maintains a

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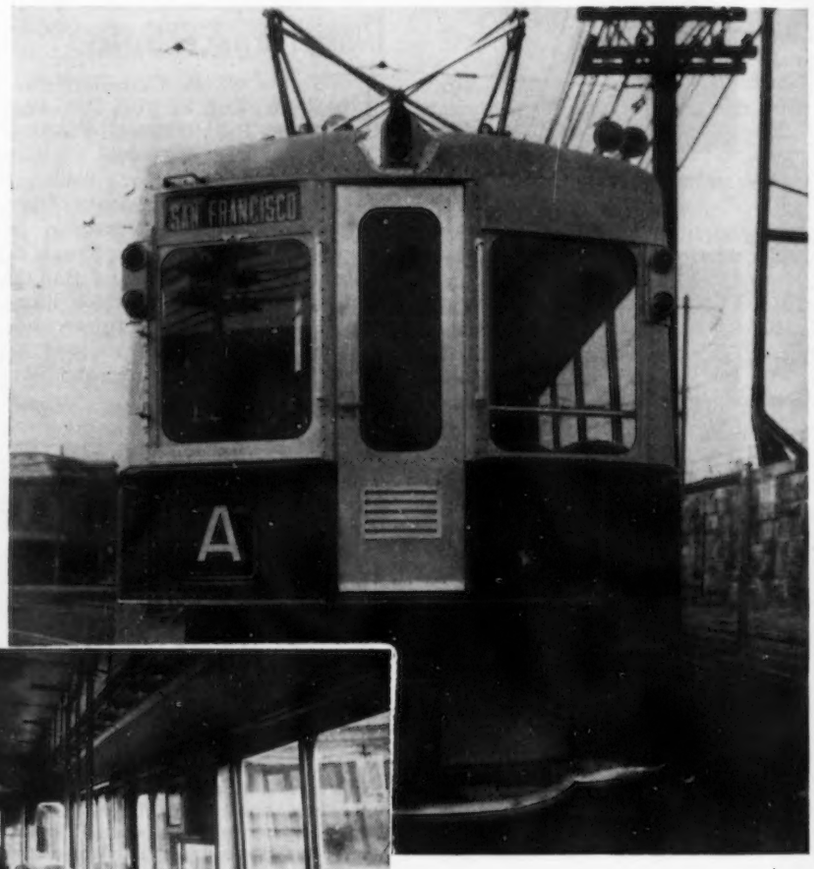
ILLUSTRATIONS show exterior and interior of new type surface cars built by Bethlehem Steel Co. for Key System to be operated across San Francisco-Oakland bridge.



constant thermostatically controlled temperature, similar in principle to the air conditioned heat now employed for residences. The ducts for the system are located between the inner and outer side walls. Electrically operated fans, capable of handling 4000 cu. ft. per min., drew in fresh air through louvers in the side skirting, at the same time filtering it. The air is then blown into the side walls and into the car through grilles placed under each seat. Except for the intake louvers and exhaust ventilators in the ceiling, the cars will be sealed. When employed for ventilation only the system will be manually controlled.

The 12 units that have been finished are the first of 23 complete units with trucks being built by the Bethlehem Steel Co., which also will build the bodies for 40 units to be mounted on trucks by the Key System at its Oakland, Cal., shops.

This Week on the Assembly Line

(CONTINUED FROM PAGE 49)

distributed by General Motors and Chrysler, as well as a host of parts plants. In addition, wage increases have been put through in the last month that will add $25,000,000 to the annual payroll of Michigan factories and in which approximately 200,000 workers will share.

To some extent these increased labor costs will be offset by reduction in costs through modernization of equipment. Machine tool dealers and factory representatives are beginning to feel a reaction from this trend and look forward to an extremely active year. Already inquiries are coming out in tremendous volume for machinery for modernization purposes, the prime objective being to cut unit costs. Another factor in the situation is the long deliveries still in effect on special purpose machinery, making it necessary for the manufacturers to enter the market very early on machinery for 1938 programs. Preliminary discussions have taken place on jobs for Plymouth, Dodge, Pontiacs and Oldsmobile cylinder block lines. Many of the advances made in production set-ups last fall will be continued into other plants such as those mentioned.

New Body Plant Opened

Chevrolet opened a new manufacturing plant for the fabrication of commercial bodies in Indianapolis last Friday. The new brick and steel construction was made practically over the conglomerate collection of wooden buildings which Chevrolet had taken over from Martin-Parry Corp. six years ago. Having nearly half a million square feet of floor space, the plant will provide production capacity for 2000 bodies a day and will supply all Chevrolet's commercial body requirements for both domestic and foreign consumption. There are more than 100 presses of various kinds and sizes in the plant, including three large ones that weigh over 340 tons.

NLRB Opens Hearing

(CONTINUED FROM PAGE 59)

made. Wage adjustments totaled 1578 during the period.

Elections by Secret Ballot

"Elections under the plans have been by secret ballot and entirely in the hands of the representatives and other employees, and the company has not taken part in any manner," said Mr. Burnett. "Counting of ballots has been solely in the hands of workmen who were neither representatives nor candidates for representative.

"More than 400 representatives deal with the Carnegie-Illinois management for the men, and the high interest of the workmen in the plan is shown by the fact that virtually half the representatives at each annual election are new men. More than 10 candidates have sought one nomination for representative at various times.

"The plans have enabled the employees and management to discuss their problems fully and freely in a friendly manner."

Supreme Court Decision in J. & L. Case Awaited

The constitutionality of the Wagner Labor Act will be argued befor the Supreme Court Feb. 8. The case involves an appeal by the National Labor Relations Board from the decision of the Fifth Circuit Court of Appeals in New Orleans dismissing a board proceeding against the Jones & Laughlin Steel Corp. The court held that the act was invalid when the board attempted to enforce an order against the Jones & Laughlin company to cease alleged discrimination against the Amalgamated Association of Iron, Steel and Tin Workers, now a CIO unit, as a collective bargaining agency. Declaring that manufacturing is not interstate commerce, the court held that the board had no jurisdiction on wage relations between the company and its employees.

In the hearing last week in the Carnegie-Illinois case, voluminous exhibits were placed in the record by the board's attorney, G. L. Patterson, to support its argument that activities of the steel industry employees are interstate commerce. The board realizes that on this issue hinges the greatest source of attack and it is vigorously attempting to buttress its position. So eager is it to have the act's constitutionality upheld that Chairman Madden has done the unusual thing of announcing that he will appear before the Supreme Court in support of the act. The Department of Justice is the sole authorized source to support the Government's legal activities before the court. It is said there is resentment that Madden is planning to interject himself before the court, even though he does it as a representative of the Department of Justice rather than as chairman of the Labor Board.

Nor is this the only resentment directed against the board. The strife-torn American Federation of Labor is said to have grown distinctly sour on the board. It is reported that officials of the federation recently protested to the board that it is doing entirely too much CIO "promotion work," and strongly hinted that the Federation would act unfavorably unless there is a lessening of the board's CIO activities.

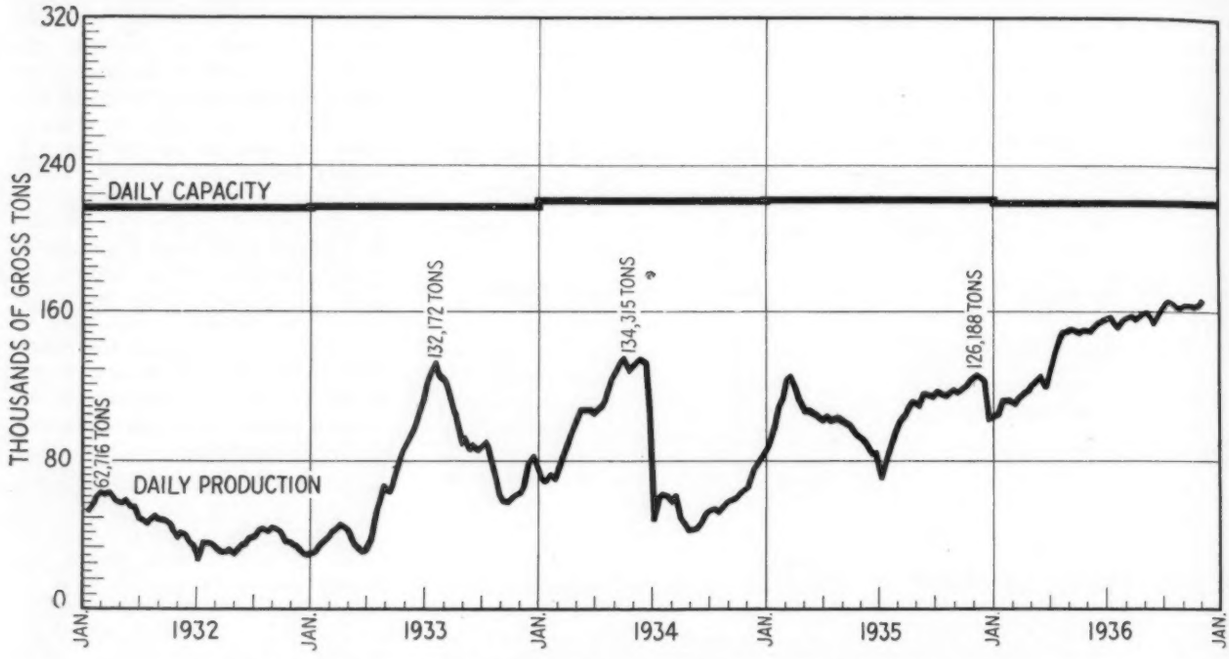
Floating Drydock Needs More Money

WASHINGTON, Dec. 21.—An additional appropriation for the construction of the large floating dock for the Navy Department is expected to be asked of Congress soon after it convenes. That the present appropriation of $10,000,000 is inadequate in indicated by the fact that after representatives from the Mare Island, Cal., and Puget Sound, Wash., submitted estimates at a conference in Washington last week and returned to their stations, Secretary of the Navy Swanson said no further action would be taken toward awarding the contract until after Congress meets. Their estimates apparently were in excess of the money available. Recently the bid of the Bethlehem Steel Co. was rejected because it exceeded the appropriation.

STEEL INGOT PRODUCTION

Daily Tonnage of Bessemer and Open-Hearth Steel Ingots Produced by Weeks, 1932-1936

Current Week	Last Week	Weeks Ended Dec. 28, 1935	Dec. 29, 1934	Dec. 30, 1933	Dec. 31, 1932
171,189	173,384	107,370	80,369	82,337	28,114



Figures for the current week are not indicated on the chart until the following week.

STEEL INGOT PRODUCTION BY DISTRICTS: Per Cent of Capacity

District	Current Week	Last Week	Weeks Ended Nov. 28, 1936	Dec. 28, 1935	Dec. 29, 1934
Pittsburgh	78.0	79.0	71.0	35.0	24.0
Chicago	70.0	77.5	77.0	53.5	37.0
Valleys	84.0	80.0	74.0	56.0	41.0
Philadelphia	56.5	54.5	54.5	33.0	26.0
Cleveland	76.0	76.0	78.0	57.0	56.0
Buffalo	84.0	84.0	84.0	45.0	41.0
Wheeling	93.0	94.0	86.0	68.0	70.0
Southern	69.5	69.5	69.5	50.0	29.0
Ohio River	95.5	91.0	95.0	82.0	50.0
Western	76.5	76.5	59.0	40.0	25.0
St. Louis	75.0	75.0	72.0	66.0	30.0
Detroit	100.0	100.0	100.0	95.0	66.0
Eastern	85.0	85.0	85.0	40.0	30.0
Aggregate	78.0	79.0	74.5	48.5	36.5
Average Year to Date	67.1	66.9	66.3	48.2	37.1

Weekly Booking of Construction Steel

From THE IRON AGE

	Week Ended Dec. 21, 1936	Dec. 15, 1936	Nov. 24, 1936	Dec. 24, 1935	Year to Date 1936	1935
Fabricated structural steel awards	23,855	29,920	18,365	17,555	1,041,380	788,470
Fabricated plate awards	175	3,115	1,390	4,900	202,305	168,185
Steel sheet piling awards	2,355	0	400	180	56,315	66,205
Reinforcing bar awards	4,095	4,775	8,140	5,700	325,675	316,190
Total Lettings of Construction Steel	30,480	37,810	28,295	28,335	1,526,675	1,339,050

. . . SUMMARY OF THE WEEK. . . .

. . . Automobile industry strikes offer steel threat; some orders held up.

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. . . Heavy December business adds to large November backlogs.

o o o

. . . Foreign pig iron inquiry upward of 100,000 tons; scrap higher.

DESPITE the threat to motor car production in labor troubles at plants of parts and materials suppliers and interruption in steel making caused by Christmas holidays at the week end, steel ingot output is maintaining a volume seldom equaled at this time of year. Based on a five-day week, the rate for the country is about 78 per cent and may go higher next week, when there will be no holiday observance. Although steel production is off slightly in some districts, the reverse is true in the Ohio Valleys, where the rate has risen from 80 to 84 per cent.

Unless labor troubles in the automobile industry are speedily settled, widespread shutdowns are likely to occur. Ford Motor Co. has announced that some of its branch plants will suspend for several days; unofficial reports state that the shutdowns may last 10 days, starting Dec. 24. The Chrysler Corp. has issued indefinite hold-up orders on parts supplied on the outside for Plymouth and Dodge cars. Some mills have received instructions to postpone shipments of sheets and strip. While the steel industry is watching the situation with anxiety, the delays in rolling automobile steel may afford some relief in the intense pressure being put on sheet and strip mills.

Labor troubles at steel plants are not expected to develop immediately, although the automobile industry's situation points to methods that may eventually be pursued. Threatenng press statements by the Steel Workers' Organizing Committee are evidently issued to impress industry, the public and the Government with its pretended strength.

MEANWHILE, a very heavy volume of business in bars, shapes and plates is being piled on the almost unprecedented tonnage of other products booked in November. Steel companies whose finishing capacity runs largely to the heavier products are in some instances booking more tonnage this month than in November. This is accounted for by the many coverages for identified construction projects, including railroad equipment. An advance of $4 a ton in concrete reinforcing bars, with a Dec. 23 deadline on protection at the old price, has driven in a large tonnage in this product. Shipments against much of the building work, for which protection is being obtained on bars, shapes and plates, probably will not be completed for several months.

As an indication that the heavy buying of the past few weeks has been speculative only to a small degree, many customers have come into the market for additional tonnages of sheets and strip, paying the higher prices quoted for the first quarter.

RAILROAD buying was again a feature of the week. The Bessemer & Lake Erie ordered 2000 cars, the Union Railroad 900, the Western Pacific 300, the Great Northern 500 ore cars, and the Lake Superior & Ishpeming may buy 100 to 200. The Missouri Pacific has asked court permission to expend about $9,000,000 for new equipment and $2,500,000 for rails and track supplies. The St. Louis-San Francisco has been authorized to spend $5,357,353 for equipment and $1,160,297 for track work. The Norfolk & Western has ordered 40,000 tons of rails.

THE world-wide shortage of steel, accentuated abroad by the feverish activity in rearmament, is having marked repercussions in this country. Imports of finished steel and pig iron are lessening; some steel importers are trying to obtain supplies from domestic mills without much success. Foreign inquiry for pig iron totals more than 100,000 tons, a Japanese trading company in Seattle having alone broadcast an inquiry for that amount of basic, foundry and malleable grades. Within the past week orders for 25,000 tons or more of pig iron for shipment to Japan have been taken by American producers. A Japanese order for 6000 tons of sheet bars brought a price higher than the new domestic quotation. Russia has been a very large buyer of sheets.

Added to coke and pig iron shortages that have given the mills trouble for some weeks is another runaway market in scrap, with further advances of 50c. a ton at Chicago and Philadelphia, and 25c. at Pittsburgh, bringing THE IRON AGE composite price to $17.75, highest since Jan. 13, 1925, when it was $20.83. Pig iron shipments to foundries and non-integrated steel plants are the heaviest of the year and are reducing makers' stocks to a low point. A Cleveland producer has sold 20,000 tons for first quarter at the $1 a ton advance recently announced.

. . . PITTSBURGH . . .

. . . Ingot output off slightly this week owing to week-end holidays.

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. . . Heavy backlogs will assure rapid pick-up next week.

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. . . Identified construction projects are now adding to mill bookings.

PITTSBURGH, Dec. 21. — Not counting the Christmas holiday, ingot output in the Pittsburgh district, based on a five-day work week, is off one point to 78 per cent of capacity. This drop is only temporary and is occasioned by the fact that some producers will lose one or two turns on Saturday, but others have speeded up production to offset some of the loss this week. Steel ingot output in the Wheeling district is down one point to 93 per cent of capacity. In view of the heavy backlogs at the mills, a rebound in ingot output is expected next week.

Compared with previous weeks, steel buying in the past six days has been lighter in volume, as practically all producers are out of the market at fourth quarter prices. About the only tonnages being placed now are heavy plates and shapes for identified projects and reinforcing bar bookings in anticipation of the price advance announced to go into effect this week. Distributers' prices of billet reinforcing bars have been advanced $4 a ton, effective Dec. 23. Likewise, an advance of $4 a ton has been made on rail steel reinforcing bars. On identified projects for which bids are in prior to Dec. 23, protection at the old price will be given until Jan. 15, by which time firm contracts must be made.

Backlogs on heavy plates and shapes are mounting, with indications that production of these items will be exceptionally heavy during the first half of 1937. Jobs involving substantial tonnages are nearing the final stage and will be announced shortly. An increase in privately financed projects is noticeable. The American Bridge Co. has been awarded a contract for 1300 tons of fabricated material for a bridge at Corona, Long Island. Jones & Laughlin Steel Corp. will furnish 1530 tons of steel sheet piling for a levee wall at Munroe, La.

Raw material markets are firm, with an advance of 25c. a ton in No. 1 heavy melting scrap. Loss of coke production over the holiday will find this market the tightest in years.

Pig Iron

The pig iron situation is the tightest in several years. Stocks of both merchant and steel-making iron are almost non-existent. Producers are being pushed for deliveries. Where two or three months ago pig iron producers were anxious to book tonnages, today, even with higher prices in effect, their main attention is directed toward taking care of orders on the books. Current iron consumption is practically keeping up with production.

Semi-Finished Steel

Practically all producers of semi-finished material are out of the market at fourth quarter prices, having taken all the business they can ship through January. Though non-integrated makers specified heavily, there is little evidence of purely speculative tonnages having been booked. In fact, some buyers who several weeks ago thought they had ordered liberally, are now finding they underestimated actual consumption. Some business, which was turned down by mills at fourth quarter prices, has been placed on the books at the new quotations.

Bolts, Nuts and Rivets

A last minute rush by customers having contracts to escape higher prices is on. Specifications in the past week stepped up considerably. Demand is emanating from practically every type of user and is particularly heavy from automobile manufacturers and railroad car builders. Miscellaneous sources are specifying freely.

Bars

Although orders received in the past week are not of the same volume as those booked earlier in the month, producers are still receiving last-minute specifications against fourth quarter contracts. Producers have booked almost all they can possibly ship in January, and even those mills which have some room on finishing mill schedules are not encouraging the placing of new orders at fourth quarter prices. Within the next month those who schedule finishing mill operations will be in a predicament, a duplicate of which has not occurred since pre-depression days. Adding to the confusion are fair-sized tonnages of reinforcing bars booked in anticipation of the price advance on this item. There has been no letup in alloy bar demand, and considerable forward buying by farm implement and tractor manufacturers is still taking place.

Cold-Finished Bars

This month's will be the best December tonnage since 1930. Orders are still pouring in and indications are that mills will have difficulty in completing shipments by the end of January, owng to the inability to obtain hot bar stock. While one or two of the large interests have ordered material enough to last for three months, on the whole there has not been as much forward buying as commonly thought. Tonnages booked recently are to be shipped at the mills' convenience, but there is pressure from some sources for better delivery.

Reinforcing Bars

Billet reinforcing bars to the building trade have been advanced $4 a ton to $2.25 a 100 lb., f.o.b. Pittsburgh, effective Dec. 23. The jobbers' price has been moved up $3 a ton from 1.75c. a lb. to 1.90c. a lb., f.o.b. Pittsburgh, for stock lengths. The 10c. extra for cut lengths on jobbers' orders is still in effect. Specifications at present prices must be placed prior to Dec. 23, subject to shipment at the mills'

A Comparison of Prices

Market Prices at Date, and One Week, One Month, and One Year Previous; Advances Over Past Week in Heavy Type, Declines in Italics

Rails and Semi-finished Steel

Per Gross Ton:	Dec. 21, 1936	Dec. 15, 1936	Nov. 24, 1936	Dec. 23, 1935
Rails, heavy, at mill	$39.00	$39.00	$36.37½	$36.37½
Light rails, Pittsburgh	35.00	35.00	35.00	35.00
Rerolling billets, Pittsburgh	32.00	32.00	32.00	29.00
Sheet bars, Pittsburgh	32.00	32.00	32.00	30.00
Slabs, Pittsburgh	32.00	32.00	32.00	29.00
Forging billets, Pittsburgh	39.00	39.00	39.00	35.00
Wire rods, Nos. 4 and 5, P'gh	43.00	43.00	40.00	40.00
	Cents	Cents	Cents	Cents
Skelp, grvd. steel, P'gh, lb.	1.80	1.80	1.80	1.80

Finished Steel

Per Lb.:	Cents	Cents	Cents	Cents
Bars, Pittsburgh	2.05	2.05	2.05	1.85
Bars, Chicago	2.10	2.10	2.10	1.90
Bars, Cleveland	2.10	2.10	2.10	1.90
Bars, New York	2.40	2.40	2.40	2.20
Plates, Pittsburgh	1.90	1.90	1.90	1.80
Plates, Chicago	1.95	1.95	1.95	1.85
Plates, New York	2.19	2.19	2.19	2.09
Structural shapes, Pittsburgh	1.90	1.90	1.90	1.80
Structural shapes, Chicago	1.95	1.95	1.95	1.85
Structural shapes, New York	2.16¼	2.16¼	2.16¼	2.06¼
Cold-finished bars, Pittsburgh	2.35	2.35	2.35	1.95
Hot-rolled strips, Pittsburgh	2.15	2.15	1.95	1.85
Cold-rolled strips, Pittsburgh	2.85	2.85	2.60	2.60
Hot-rolled annealed sheets, No. 24, Pittsburgh	2.80	2.80	2.60	2.40
Hot-rolled annealed sheets, No. 24, Gary	2.90	2.90	2.70	2.50
Sheets, galv., No. 24, P'gh	3.40	3.40	3.20	3.10
Sheets, galv., No. 24, Gary	3.50	3.50	3.30	3.20
Hot-rolled sheets, No. 10, Pittsburgh	2.15	2.15	1.95	1.85
Hot-rolled sheets, No. 10, Gary	2.25	2.25	2.05	1.95
Cold-rolled sheets, No. 20, Pittsburgh	3.25	3.25	3.05	2.95
Cold-rolled sheets, No. 20, Gary	3.35	3.35	3.15	3.05
Wire nails, Pittsburgh	2.25	2.25	2.05	2.40
Wire nails, Chicago dist. mill	2.30	2.30	2.10	2.45
Plain wire, Pittsburgh	2.60	2.60	2.50	2.30
Plain wire, Chicago dist. mill	2.65	2.65	2.55	2.35
Barbed wire, galv., P'gh	2.70	2.70	2.55	2.80
Barbed wire, galv., Chicago dist. mill	2.75	2.75	2.60	2.85
Tin plate, 100-lb. box, P'gh	$5.25	$5.25	$5.25	$5.25

On export business there are frequent variations from the above prices. Also in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

Pig Iron

Per Gross Ton:	Dec. 21, 1936	Dec. 15, 1936	Nov. 24, 1936	Dec. 23, 1935
No. 2 fdy., Philadelphia	$22.3132	$22.3132	$22.3132	$21.3132
No. 2, Valley furnace	20.50	20.50	20.50	19.50
No. 2, Southern Cin'ti	20.44	20.44	20.44	20.2007
No. 2, Birmingham†	16.88	16.88	16.88	15.50
No. 2, foundry, Chicago*	20.50	20.50	20.50	19.50
Basic, del'd eastern Pa.	21.8132	21.8132	21.8132	20.8132
Basic, Valley furnace	20.00	20.00	20.00	19.00
Malleable, Chicago*	20.50	20.50	20.50	19.50
Malleable, Valley	20.50	20.50	20.50	19.50
L. S. charcoal, Chicago	26.2528	26.2528	25.7528	25.2528
Ferromanganese, seab'd, carlots	80.00	80.00	75.00	85.00

†This quotation is subject to a deduction of 38c. a ton for phosphorus content of 0.70 per cent or higher.
*The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

Scrap

Per Gross Ton:				
Heavy melting steel, P'gh	**$19.25**	$18.00	$17.25	$14.25
Heavy melting steel, Phila.	**16.25**	15.75	14.75	12.50
Heavy melting steel, Ch'go.	**17.75**	17.25	16.50	13.25
Carwheels, Chicago	18.00	18.00	16.50	13.25
Carwheels, Philadelphia	17.25	17.25	16.75	13.00
No. 1 cast, Pittsburgh	**17.25**	16.75	16.25	14.25
No. 1 cast, Philadelphia	17.25	17.25	16.75	13.00
No. 1 cast, Ch'go (net ton)	15.00	15.00	14.00	11.75
No. 1 RR. wrot., Phila.	15.75	15.75	15.75	12.25
No. 1 RR. wrot., Ch'go (net)	15.00	15.00	14.25	11.00

Coke, Connellsville

Per Net Ton at Oven:				
Furnace coke, prompt	$4.00	$4.00	$3.75	$3.50
Foundry coke, prompt	4.50	4.50	4.25	4.00

Metals

Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Electrolytic copper, Conn.	11.00	11.00	10.50	9.00
Lake copper, New York	11.12½	11.12½	10.62½	9.37½
Tin (Straits), New York	*52.00*	52.50	52.00	48.62½
Zinc, East St. Louis	**5.45**	5.25	5.05	4.85
Zinc, New York	**5.82½**	5.62½	5.42½	5.22½
Lead, St. Louis	**5.85**	5.25	5.05	4.35
Lead, New York	**6.00**	5.50	5.20	4.50
Antimony (Asiatic), N. Y.	12.62½	12.62½	12.50	14.50

The Iron Age Composite Prices

	Finished Steel	Pig Iron	Steel Scrap
Dec. 21, 1936	2.274c. a Lb.	$19.73 a Gross Ton	$17.75 a Gross Ton
One week ago	2.274c.	19.73	17.33
One month ago	2.197c.	19.73	16.17
One year ago	2.130c.	18.84	13.33

Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strips. These products represent 85 per cent of the United States output.

Based on average of basic iron at Valley furnace and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

	Finished Steel High	Finished Steel Low	Pig Iron High	Pig Iron Low	Steel Scrap High	Steel Scrap Low
1936	2.274c., Dec. 8	2.084c., Mar. 10	$19.73, Nov. 24	$18.73, Aug. 11	$17.75, Dec. 21	$12.67, June 9
1935	2.130c., Oct. 1	2.124c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, April 23
1934	2.199c., April 24	2.008c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	2.015c., Oct. 3	1.867c., April 18	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.977c., Oct. 4	1.926c., Feb. 2	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	2.037c., Jan. 13	1.945c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.273c., Jan. 7	2.018c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.317c., April 2	2.273c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3
1928	2.286c., Dec. 11	2.217c., July 17	18.59, Nov. 27	17.04, July 24	16.50, Dec. 31	13.08, July 2
1927	2.402c., Jan. 4	2.212c., Nov. 1	19.71, Jan. 4	17.54, Nov. 1	15.25, Jan. 11	13.08, Nov. 22

convenience before the end of January. Identified projects on which bids are in prior to Dec. 23 will be given protection until Jan. 15, before which time contracts must be arranged.

Effective Dec. 23, the price on rail reinforcing bars will be advanced $4 a ton to 2.10c. a lb. f.o.b. Pittsburgh.

Tin Plate

The Christmas holidays will be observed by a shutdown on both Friday and Saturday, reducing operations considerably this week. Specifications continue in good volume and mills will operate at practical capacity next week. Owing to heavy tonnages previously placed, backlogs are growing and there is little chance of a marked drop in operations for some time to come.

Sheets

A small amount of business at the new prices has been booked, but major interest is on production, which will be curtailed somewhat this week owing to the holidays, as some producers will not operate on Friday or Saturday. Production lost during this time will have to be made up, owing to the heavy volume of unfilled tonnage scheduled for shipment by the end of January. Those customers who were unable to correctly gage their future requirements, may have some difficulty getting steel when they come into the market in January. There is little doubt that December sheet business will be the best on record for several years.

Steel Sheet Piling

Bethlehem Steel Co. has been awarded the contract for a bulkhead at Sheepshead Bay, N. Y., requiring 825 tons of piling. Jones & Laughlin Steel Corp. will furnish 1530 tons of steel sheet piling for a concrete and steel levee wall at Munroe, La., on the Ouchita River. Bids will be taken on Dec. 22 by New York State for a bulkhead at Flushing Bay, N. Y., which will involve 1800 tons. The City of New York will take bids on Dec. 30 for 1800 tons of piling to be used in the construction of a tide gate and dam. Within the past week several small jobs aggregating less than 100 tons each have been let.

Tubular Products

Remarkable steadiness is still apparent in bookings of oil-country goods. Interest in line pipe orders has seasonally subsided, but prospects for early 1937 are good. Demand for standard pipe continues to show improvement and producers are receiving fair-sized order for both merchant and railroad boiler tubes.

Wire Products

Specifications for manufacturers' wire emanating from miscellaneous sources, such as bolt and nut manufacturers, bale tie and wood screw makers, are in good volume and indicate clearly that, although heavy bookings were placed before the price increase on Dec. 1, speculative buying did not take place. Consumption of finished products is at a high rate and it is difficult to gage, which is probably the reason why many customers underestimated their future requirements when buying last month. The demand for merchant wire items is also showing signs of activity.

Strip

A lull in new buying has occurred following withdrawal of fourth quarter prices. While some tonnage has been placed at the new quotations, the amount involved is small. Backlogs at mills are exceptionally heavy and difficulty is expected in clearing the mills of fourth quarter priced tonnage by the end of January. Possibility of a shortage of raw steel may prevent the carrying out of mills' intentions to complete shipment by the specified time.

Plates and Shapes

Backlogs on heavy plates and shapes are mounting daily and producers expect exceptionally heavy production of this type of materital at least through the first half of 1937. In addition to many railroad commitments for car building programs, a large number of manufacturing companies are planning plant additions. The American Bridge Co. will fabricate 1300 tons of plates and shapes for a New York State bridge at Corona, Long Island. The Bessemer & Lake Erie Railroad has placed contracts for 2000, including hopper and gondola types, while the Union Railroad has placed awards for 900 cars.

Coal and Coke

Production of industrial coal is at an exceptionally high rate. Owing to the necessity of producing domestic lump in order to obtain nut and slack coal for manufacturing concerns, the continuance of mild weather has resulted in lower prices for the former. A cold snap, however, will change this situation over night. Producers of beehive furnace coke have been conserving every ton available for their furnace contracts to help make up for the loss of production over the holidays. Coal and coke workers will, in some cases, not be working Friday and Saturday. The conservation of coke for furnace contracts has brought about a temporary shortage of standard grades, usually applied against spot orders.

. . . Dominion mills have large backlogs.

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. . . Operations of 70 per cent until Spring expected.

TORONTO, Dec. 21.—The year-end holiday season is having its effect on the Canadian market, and most companies are endeavoring to keep inventories low during stock taking. Most of the large iron and steel producers, however, are carrying large backlogs, and it is expected that plant operations will be maintained at a rate of around 70 per cent until next spring. The automotive industry as well as the mining branch are making good purchases at this time and other business of a diversified nature is shaping up. Prices are firming and new lists are expected soon.

Merchant pig iron sales are tapering off, but the melt is holding around 60 per cent. Iron sales for the past week dropped to around 900 tons, made up of orders ranging from 50 to 200 tons. Current demand runs largely to foundry iron, with odd-lot sales of malleable. Pig iron production in turn is holding with six furnaces blowing. Inquiries for iron for first quarter delivery are making their appearance, and it is stated that a couple of melters have covered to next April. Prices are firm and unchanged.

Trading in iron and steel scrap also has slowed down, but dealers continue to report steady shipments against contracts and new orders. Heavy melting steel is the most active on the list, while other steel lines also are moving in larger tonnage than they were a few months ago. Prices are firm and unchanged.

. . . . CHICAGO . . . .

. . . Steel production adjusted downward for the week-end holiday.

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. . . Ingot output in January expected to reach new high.

o o o

. . . Railroad equipment orders are feature of week's market news.

CHICAGO, Dec. 21—Nearly all steel producers are preparing for the holiday week by adjusting ingot production downward. The result is that production is starting the week at 70 per cent of capacity, a drop of 7½ points. The average for the week will be adjusted for Christmas Day, when all units will be closed. This drop is purely a holiday matter, there being no change in the rate at which users are willing to take steel mill products. Consumers are breaking depression practices and are cutting shutdowns to the minimum and many of them will follow steel mill practice in giving but the one holiday.

Specifications from all sources remain at a high rate, and, barring labor difficulties, there is promise that ingot production in January will reach a new high for the current upward swing.

Railroad equipment still holds the spotlight. The Great Northern has placed 500 cars and two United States Steel Corp. subsidiaries have ordered 2900 open top cars. Car shops are rapidly assembling materials for recent orders and they will exert pressure against mills for a number of weeks to come. All of the old prices on finished steel are out of the way, and the new quotations are firm. Mills have advanced reinforcing bar prices and dealers will follow suit. Scrap prices are again advancing, heavy melting steel having moved up 50c. a ton on a sale to a consumer.

Pig Iron

Holiday hold-up orders are very scarce and melters press to take shipments as fast as they can be handled. Shutdowns will be held to the minimum, as reflected by coke movement, which is well ahead of the November average. Prices for pig iron are strong.

Plates

Mills are taking on new life, and the outlook for 1937 is by far the best in five or six years. The principal factor is the rush of railroad car business, which has already reached large proportions and promises to expand still farther. The oil industry is prosperous, but its immediate steel needs are not impressive. Tank business in the Middle West is comparatively slow and pipe line orders are for short stretches. Plans are being laid to place some short connecting lines between various fields in Kansas. Plate deliveries average two weeks, or slightly less.

Structural Material

All classes of consumers continue their drive to get under cover on identified projects. The air is swarming with numerous jobs, most of which fall in the classification of less than 100 tons each. Architects are engaged in preliminary work on some larger structures, such as theaters, apartments, and office buildings, types of construction that have been dormant throughout most of the depression period. There seems to be ample funds for highway bridge and overpass construction. Each week brings forth a number of new State programs.

Rails

Railroads are now accepting shipments against recent orders. Many shipments will be spread out to the end of March. In ordinary winters rail tonnages are used to absorb excess raw steel, but this year ingots are at a premium and other finished products are getting first draw against available supplies, and rail rollings are being held low. This is no handicap to railroads, especially in the northern parts of the country, because winter weather puts a stop to all track work except that of the most essential character.

Sheets

Mills are in an extremely comfortable position as to bookings, but the delivery problem has its serious side. Promises now extend well into February on most products, the outstanding exception being the galvanized product, which though in good demand, can still be had in only a little longer time than that required for processing. The outlook for 1937 country demand for products made from galvanized sheets is exceptionally promising.

Bars

Mills are under constant pressure for deliveries. There is no doubt that there has been some pyramiding of tonnages, but the fact remains that consumption is high and there is nothing in sight which might alter the situation. Chicago producers get only encouraging words from automobile producing centers. Farm implement manufacturers are stocking heavily for spring delivery and they are enjoying a surprisingly active consumer demand. Machine tool manufacturers are working at the limit of the available labor supply.

Wire Products

The feature of this market is the way in which distributors are taking the commodities which are going into stock for spring deliveries. This is a strong reflection of their confidence in the future, an attitude which has seldom risen above a whisper during the last four or five years. There is a good movement of nails and barbed wire for stocks. Woven wire fence is still slow, but more interest in this commodity is beginning to make its appearance. Manufacturers wire remains in excellent demand and specifications point to steady movement during the holiday period.

Reinforcing Bars

Mills have advanced prices $3 a ton and dealers' resale prices have gone up $4 a ton. Although the weather has been mild the usual winter influences are at work and tonnages reaching shops are dropping. Operations now range from

50 per cent to 100 per cent of capacity, some units having been forced to discontinue night shifts. Illinois grade crossing work will continue through the winter, but plans now out show that most projects will require small tonnages. Inland Steel Co. has taken 900 tons for the second section of the Jane Addams housing project.

Cast Iron Pipe

Prices are well established at the new levels, which have not checked the flow of new business. James B. Clow & Sons Co. has taken 200 tons for shipment to Ohio. Other awards in the North-Central area are small and in all probability will remain so during the next month or two. Private interests have ordered a few car lots but utilities are dormant. Stocks are of fair size and well balanced at points where storing pipe is practiced.

..CAST IRON PIPE..

North Baton Rouge Water Works District No. 1, Baton Rouge, La., plans pipe lines for water system and other waterworks installation. Cost about $625,000, of which $281,320 will be secured through Federal grant.

Eudora, Kan., closes bids Jan. 5 for 32,460 ft. of 2, 4 and 6-in. for water system, including 13,100 lb. fittings and castings; also for 50,000-gal. elevated steel tank on 80-ft. steel tower, high and low service pumping units and auxiliary equipment. Cost about $54,000. Shockley Engineering Co., Graphic Arts Building, Kansas City, Mo., is consulting engineer.

Bellingham, Wash., has engaged Baer & Cunningham, Spalding Building, Portland, consulting engineers, to make surveys and estimates of cost for additions to pipe lines and waterworks stations for industrial water supply totaling up to 100,000,000 gal. per day, including development of new water source. John M. Adams is superintendent of water board.

Rock Hill, S. C., plans extensions in water pipe lines. Cost about $33,000. Financing is being arranged through Federal aid.

East Peoria, Ill., will take bids soon for pipe lines for extensions in water system and other waterworks installation. Kinsey Engineering Co., 515 Court Street, Pekin, Ill., is consulting engineer.

Covington, Va., closes bids Dec. 29 for pipe lines for water system and other waterworks installation. Wiley & Wilson, Peoples Bank Building, Lynchburg, Va., are consulting engineers.

Garfield Heights, Ohio, closes bids Jan. 4 for pipe lines for water system and other waterworks installation. Connection will be made with waterworks pumping station to be constructed by Garfield Heights Water Co. Cost about $42,000. Financing has been arranged through Federal aid. L. J. Gapinsky, village service director, in charge.

Vermillion, Kan., will take bids early in January for about 17,500 ft. of 2, 4 and 6-in. for water system; also for 50,000-gal. elevated steel tank on steel tower. Cost about $41,000. Paulette & Wilson, National Reserve Building, Topeka, Kan., and Farmers' Union Building, Salina, Kan., are consulting engineers.

Charlotte, N. C., plans pipe lines for extensions in water system, including replacements in present mains; also for other waterworks expansions. Cost close to $1,000,000. Robert & Co., Inc., Bona Allen Building, Atlanta, Ga., consulting engineer, will make surveys.

Wilmington, N. C., closes bids Dec. 30 for 4900 ft. of 12-in., and 200 ft. of 6-in., for extensions in water system; also for gate valves, manholes, etc. McKean Maffitt is city engineer in charge.

Braham, Minn., plans about 14,000 ft. of 4, 6 and 8-in. for water system; also new 50,000-gal. elevated steel tank on 100-ft. steel tower. Financing is being arranged through Federal aid.

Adena, Ohio, has awarded 200 tons of 6 to 12-in. pipe to James B. Clow & Sons.

Resettlement Administration, Washington, has placed 12,225 ft. of 6-in. for Ironwood, Mich., project with Lynchburg Foundry Co.

Durand, Wis., has been allotted WPA funds for water main extensions costing $25,000.

Blaine, Wash., has awarded 112 tons for water supply line to an unnamed bidder.

South Pasadena, Cal., will open bids Jan. 13 on 129 tons of various sizes for a water supply line.

South Gate, Cal., has opened bids on 216 tons of 4 and 6-in. for a water line.

Pasadena, Cal., will open bids Dec. 28 on 1000 tons of 6, 8 and 12-in. pipe for a water line.

Fresno, Cal., has awarded 545 tons of pipe to United States Pipe & Foundry Co.

Seattle has awarded 138 tons for second extension on Ranier Avenue to an unnamed bidder.

RAILROAD BUYING

Missouri Pacific has asked for authority to spend $9,026,302 for betterments for the following lines: Missouri Pacific, $7,192,547; Missouri Pacific of Nebraska, $311,950; International-Great Northern, $758,550; New Orleans, Texas & Mexico, $105,670; Beaumont, Sour Lake & Western, $37,800; St. Louis, Brownsville & Mexico, $399,480; Houston & North Shore, $510; Orange & Northwestern, $1,520, $146,600, and Missouri-Illinois, $71,705. Principal items include $2,527,610 for rails and other track materials; improvements to existing equipment, $1,393,225, of which $1,226,985 is for the Missouri Pacific; signals and interlocking plants, $681,705; locomotives, $474,000, and freight cars, $39,250.

St. Louis-San Francisco has been authorized to expend $5,357,353 for betterments, covering items listed on page 98 of THE IRON AGE of Dec. 3.

Western Pacific has ordered 200 box cars from Mount Vernon Car Co., 100 ballast cars from Rodgers Ballast Car Co., to be built at St. Louis plant of American Car & Foundry Co.; one 200-ton wrecking crane. and special shop tools.

Bessemer & Lake Erie has ordered 1000 90-ton hopper cars from Pullman-Standard Car Mfg. Co., 500 70-ton hopper cars from American Car & Foundry Co., 500 50-ton gondola cars from Greenville Steel Car Co., Greenville, Pa.

Union Railroad has awarded 600 70-ton copper-steel gondola cars to Pressed Steel Car Co., 700 70-ton gondola cars to Magor Car Corp. and 100 70-ton gondola cars to Ralston Steel Car Co.

Great Northern has ordered 500 ore cars from Bethlehem Steel Co.

Virginian has placed 25 automobile cars with Greenville Steel Car Co.

Lake Superior & Ishpeming will buy 100 to 200 cars.

American Car & Foundry Motors Co., has received the following orders for motor coaches: Norfolk-Southern Bus Corp., Norfolk, Va., one; Broad River Power Co., Columbia, S. C., nine; Penn-Ohio Coach Lines Co., Youngstown, one; Warwick Coach Lines, Malden, Mass.; one Cooke Street Line, Inc., Waterbury, Conn., one; Connecticut Co., New Haven, seven.

RAILS AND TRACK SUPPLIES

Missouri Pacific has asked for authority to spend $2,527,610 for rails and other track materials apportioned as follows: Missouri Pacific, $2,067,900; Missouri Pacific of Nebraska, $68,100; International-Great Northern, $223,020; New Orleans, Texas & Mexico, $10,220; Beaumont, Sour Lake & Western, $10,920; St. Louis, Brownsville & Mexico, $73,210; Houston & North Shore, $510; San Antonio, Uvalde & Gulf, $32,930, and Missouri - Illinois, $30,800.

St. Louis-San Francisco has been granted authority to spend $1,160,297 for track work, including 75 miles of 112-lb. rails, $822,321; tie plates for new rails, $135,528, and 800,000 tie plates and accessories, $200,000.

Norfolk & Western has ordered 30,000 tons of 131-lb. rails from Carnegie-Illinois Steel Corp. and 10,000 tons from Bethlehem Steel Co.

..SAN FRANCISCO..

. . . Western Pipe & Steel Co. low on 6000 tons of pipe.

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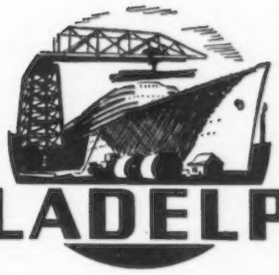
. . . California mills are operating near capacity.

SAN FRANCISCO, Dec. 21—Western Pipe & Steel Co. was low bidder last week on 6000 tons of pipe to be used in a water supply line from Lake Champlain to Everett, Wash. This project calls for 103,920 ft. of 48-in. and 20,710 ft. of 52-in. pipe at an estimated cost of slightly over $1,000,000. No important awards were made during the week.

Bids have been called on three new cast iron pipe projects, totaling 1346 tons. Largest of these is a Pasadena, Cal., project, which calls for 57,000 ft. of 6, 8, and 12-in. pipe, about 1000 tons; bids will be opened Dec. 28. South Gate, Cal., has opened bids on 216 tons and South Pasadena, Cal., will open bids Jan. 13 on 129 tons to be used in a water supply line.

Though the steel market is extremely inactive, with few building projects going forward, mill activity on the Pacific Coast has been maintained surprisingly well, most mills operating at near capacity. Jobbers are just now beginning to be seriously damaged by the maritime strike, now in its seventh week, and are optimistic about prospects for 1937. Settlement of the maritime strike in the near future seems likely as both sides show signs of weakening. Difficulties will probably not be ironed out, however, until after the first of the year.



. . PHILADELPHIA . .

. . . Operations up two points to 56½ per cent of capacity.

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. . . Additional blast furnaces to begin operation soon.

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. . . Many inquiries for higher-priced steel.

PHILADELPHIA, Dec. 21—The district operating rate advanced two points to 56½ per cent this week as open-hearth activities were increased at Bethlehem. Operations at other district mills remain the same as last week. Blast furnace operations also are feeling the effect of recent heavy demand. Alan Wood's second Swedeland furnace will go into blast next week, and the Colonial Iron Co.'s Riddlesburg, Pa., stack may be blown in about Feb. 1.

Sales offices generally have been ordered to adhere closely to the Jan. 31 delivery limit set for business taken at fourth quarter prices, and in nearly all cases are submitting every inquiry to their mills before acceptance. All sheet sellers, who for some time have been out of the market on low-priced tonnages, report moderate interest in first quarter orders at new price levels. Low-price plates and shapes are still available, and consumers are taking advantage of this opportunity to place some forward requirements.

Following the recent decision of the I.C.C. refusing an extension of railroad freight emergency surcharges after the first of the year, some requests have been received by steel companies from customers to defer shipments so that the decrease in rates may be of benefit to them. Although, as far as is known at present, no mill has announced a policy on this question, it is the belief of representatives here that such requests will be given scant consideration in view of the confusion in rolling and shipping schedules such action would entail.

Pig Iron

That the Japanese inquiry several weeks ago for 50,000 tons of iron has met with favorable response is evidenced by the fact that around 30,000 tons has already been sold, the major portion coming from this district. Alan Wood Steel Co., whose larger furnace at Swedeland is being prepared to go into blast some time this month, figured in the transaction, as did the Woodward Iron Co., Sloss-Sheffield and the Troy furnace. With major consumers covered against first quarter needs, business elsewhere is light and is expected to remain rather quiet for a month or so. Sellers are eyeing the possibility of another price advance now that steel scrap prices again are booming, and if the latter increase much further, such action is considered probable. It is understood that the Colonial Iron Co. has obtained additional Federal funds for final preparation of its Riddlesburg, Pa., furnace, so that it can go into blast on about Feb. 1. Preparations for the return to blast of the Chester unit, the possibilities of which were discussed some weeks ago, have apparently made little headway, and such a move is unlikely to occur soon.

Plates and Sheets

Plate business is still being taken in most offices for delivery before Jan. 31. No orders or inquiries for important tonnages have been reported. A great deal of the identified contracts now out are being closed and specifications from this source alone should occupy mills for much of the first quarter. The Pennsylvania Railroad is understood to be considering heavy repairs for about 28,000 cars and over 1000 locomotives. Additional equipment repairs also may be made. The tremendous demand for sheets over the past month or so has succeeded in tying up mills and disrupting shipping schedules, as has been the case only a few times in the past. One large sheet maker, who is currently quoting deliveries of from 14 to 15 weeks on hot-rolled annealed and galvanized sheets, thus precluding the possibility of taking much additional business next quarter, has not been in a similar position since the early "twenties." A number of inquiries at the new prices are being received, however, and any sizable slump in business late in the next quarter is extremely unlikely.

Shapes and Bars

Awards this week in both structural shapes and reinforcing bars were the best for several months, 5555 tons of shape awards and 1860 tons of bars being reported. Bethlehem Steel Co. obtained the largest single contract, 4700 tons of shapes for the Delaware River bridge at Easton, Pa., and also was awarded 180 tons for a crossing elimination at Hammonton, N. J. In Trenton, the L. A. Young Spring & Wire Co. building requiring 675 tons, was awarded to Bethlehem Fabricators, Inc. About 1500 tons of shapes are outstanding in several small highway jobs over the state of Pennsylvania and will be bid Jan. 8. Bethlehem also secured the major portion of the reinforcing steel awards, when the contract for 1200 tons of bars for the Campbell Soup Co. structure in Camden was secured. In addition, this company was awarded 535 tons for several highway projects over the state. Bids will be taken Jan. 6 on two Philadelphia schools which have been under consideration for some time and involve substantial tonnages of shapes and bars.

Imports

The following iron and steel imports were received here last week: 2850 tons of chrome ore from Cuba; 1937 tons of scrap iron from the Dominican Republic; 8250 tons of manganese ore from the Gold Coast; 29 tons of steel tubes, 20 tons of steel forgings, 52 tons of cold drawn steel wire, 58 tons of steel bars and 1 ton of steel sheets from Sweden, and 124 tons of steel sheets from Germany.

Employment at the Granite City Steel Co. is at virtually the same level as the peak year of 1929, according to Hayward Niedringhaus, president. In 1934 the payroll showed approximately 2000 men, Mr. Niedringhaus said, but these employees were working less than half time. Today, he added, there are over 2900 full-time employees.

Homestead Steel Works Employees Strike Back at CIO Statements

PITTSBURGH, Dec. 22.—Striking back at the Steel Workers Organizing Committee, employee representatives of Carnegie-Illinois Steel Corp.'s Homestead works, through their chairman, John J. Wilson, branded as self-confessed "spies" those representatives who testified on behalf of the SWOC at the recent labor hearings in Washington.

According to the Homestead representatives, testimony given by the pro-Lewis witnesses cast reflection upon the ability, honesty and sincerity of all employee representatives and attempted to ridicule the whole plan of employee representation. Mr. Wilson further suggested that the Carnegie-Illinois Steel Corp. subpoena representatives from the general body at the Homestead steel works for the purpose of defending the employee plant. His letter addressed to the manager of industrial relations, Carnegie-Illinois Steel Corp., follows:

"On reviewing the evidence being presented by CIO (Lewis organization) in its case against the Carnegie-Illinois Steel Corp. before the National Labor Relations Board, I find Mr. Lewis to be using employees' representatives as witnesses through whom he is attempting to prove that there is no collective bargaining under the plan of employee representation.

"Certainly the testimony of some of these representatives would indicate that the employees in some instances have made an unfortunate choice in their selection of employee representatives since they have assumed the not very enviable position of being self-confessed 'spies.'

"In summing up the testimony presented at this hearing through the present writing, I am convinced, first, that it attempts to cast reflection upon the ability, honesty and sincerity of all representatives; second, that it attempts to ridicule the plan of employee representation as the collective bargaining agency; third, that the impression that the employees of the steel industry are not capable of handling their own affairs, but are a gullible people who can be stampeded any way the management desires; and fourth, that its main object is to force the employees of the steel industry into a Lewis-dominated union.

"In the light of this testimony, I feel justified in asking that the Carnegie-Illinois Steel Corp. subpoena representatives from the general body at Homestead steel works for the purpose of defending the employees' representatives in general, the employees' representation plan and the employees in testimony that will refute these charges that supposedly are aimed at the corporation but in reality are aimed at employees' representatives who refused to bow to the dictatorship of John L. Lewis.

"I wish to emphasize at this time the fact that after the CIO has completed its testimony and the corporation has presented its answer, the story is not yet complete, and will not be complete until representatives under the plan of employee representation have had opportunity to present their side of the case as such. I feel that the National Labor Relations Board and the general public should be informed of all the facts.

"It is our purpose at Homestead to protect the interests of the workers whom we represent and to aid industry to thrive rather than retard its recovery. Hence, it is further necessary that we serve notice on all concerned that we will oppose any legislation in the State of Pennsylvania that may result in driving industry from the confines of the State and visit privation upon the general public that depends upon industry for its livelihood."

HERMAN H. LIND has resigned, effective Jan. 1, as general manager of the National Machine Tool Builders' Association, Cleveland, to become executive vice-president of the American Institute of Bolt, Nut and Rivet Manufacturers, with offices in Cleveland. He has been with the association since September, 1932. As an acknowledgment of his services the directors adopted a resolution expressing the appreciation and thanks of all the members "for the high achievements attained by the association under his leadership."

H. H. LIND

FRANK J. KINNEY has joined the sales force of the Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y. He will be located at 5405 Penn Avenue, Pittsburgh, and will assist ROY W. HURST, district manager.

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A. W. DANIELS, formerly vice-president in charge of sales of the American Manganese Steel Co., Chicago, has been made president of the Universal Crusher Co., Cedar Rapids, Iowa, succeeding W. L. HARRISON, who has been with the company since 1912. Mr. Daniels has long been identified with the industries that consume crushing equipment, having been with the Manganese Steel company for some 18 years. More recently he served as executive officer of the Rock Crusher Manufacturers' Association and as secretary-treasurer of the Manganese Steel Founders' Association.

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GEORGE C. EWING has been appointed New England representative, with sales office at 10 High Street, Boston, for the Ajax Flexible Coupling Co., Westfield, N. Y.

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E. P. STROTHMAN, who has been identified with the sales engineering department of the A. O. Smith Corp., Milwaukee, since 1929, has been appointed sales manager of the ceramic products department of the company.

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WALTER N. STANCATI has joined the Pittsburgh office of the Foxboro Co., Foxboro, Mass., and ROGER W. ALLEN has been appointed sales engineer in the Atlanta office.

. . . CLEVELAND . . .

. . . Valley operations rise to 84 per cent on five-day basis.

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. . . Steel makers watching labor situation in motor industry with anxiety.

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. . . Steel-making scrap advances $1.25 a ton in an excited market.

CLEVELAND, Dec. 21.—Ingot output in the Cleveland-Lorain district is unchanged this week at 76 per cent of capacity. The rate in the Valley district has increased four points to 84 per cent of capacity. These rates are based on five days' operations, not taking into consideration the holiday shutdown, which will be for only Christmas Day. Two additional open hearths were put on in Cleveland, but this increase was offset by lower bessemer output in Lorain.

New demand for finished steel continues heavy for the products mills can enter for January rolling. This applies particularly to bars, plates and shapes. Considerable sheet business has been taken for February shipment at the new prices and some mills have all the cold rolled sheets on order that they can produce in February.

The labor situation in the motor car industry is being watched with considerable anxiety by steel makers. Interference with production schedules has already resulted in the holding up of some shipments of sheets by Ohio mills. Orders for wire products at present prices are being turned down because mills are filled up. Railroads are placing orders for steel for the first quarter for repair work.

The new steel prices will become effective Jan. 1 on all products that have been advanced, even if a mill on that date still has tonnage available for January rolling. Reinforcing bars have finally been advanced $3 a ton to distributers, effective immediately, and $4 in the distributers' resale prices.

Scrap prices continue to move up in an excited market. Steel-making grades have advanced $1.25 a ton in Cleveland.

Pig Iron

Shipments against old orders continue very heavy, and the December movement will show a large gain over that of November. Buying for the first quarter at the $1 a ton advance in price continues in fair volume. One producer has sold 25,000 tons at the higher price. An inquiry for 100,000 tons of foundry, malleable and basic iron has reached local producers from the Saito Trading Corp., Seattle.

Iron Ore

Consumption of Lake Superior ore during November amounted to 4,269,049 tons, a decrease of 115,760 tons, which was due to the shorter month. The total melted in November last year was 3,025,694 tons. Furnace stocks Dec. 1 amounted to 30,459,720 tons and stocks at furnaces and Lake Erie docks were 35,378,068 tons. This is somewhat over a million tons more than the amount of ore on furnace yards and docks on Dec. 1 last year, when the total was $34,276,968 tons. The balance on Lake Erie docks Dec. 1, amounting to 4,918,348 tons, was 394,917 tons less than on the same date a year ago. Ore receipts at Lake Erie ports during the entire season were 31,312,182 tons, an increase of 11,422,378 tons over 1925. Shipments from these ports during the season were 23,481,986 tons, a gain of 9,469,539 tons over 1935. November receipts at these ports were 3,015,495 tons, a gain of 1,542,810 tons over the same month last year. Lake front furnaces received 7,790,470 tons during the season, an increase of 2,555,404 tons over last year. Ports other than on Lake Erie received 12,824,487 tons during the season, an increase of 4,672,432 tons over last year. There was 138 furnaces using Lake ore in operation Dec. 1, the same as on Nov. 1.

Bars, Plates and Shapes

Bookings of steel bars continue good, although not quite as heavy as earlier in the month. Mills are still taking orders for most sizes for January rolling at the fourth quarter prices. Some sales have been made at the $3 a ton advance for February shipment. Orders for structural shapes are heavy and additional protections for specific work have been taken for a considerable tonnage. Plates are quite active. Mills can still take plate and shape orders for January shipment and these are being entered at fourth quarter prices. Grade crossing elimination work in Lorain County requiring 750 tons has been awarded by the State Highway Department to the Burger Iron Co. Bids were taken for an addition to the plant of the Cleveland Twist Drill Co., requiring 800 tons of shapes.

Strip Steel

Mills have become filled up with all the hot strip they can roll during January and are taking no more business at fourth quarter prices. The same situation has applied to cold strip for several weeks. Some orders have been taken at the new prices for February shipment.

Reinforcing Bars

A price advance of $3 a ton was announced late last week on both billet steel and rail steel reinforcing bars, effective immediately, this advance being the same as was made recently on merchant bars. The new prices are 1.90c., Pittsburgh, and 1.95c., Cleveland, for billet steel bars in straight lengths to distributors. Rail steel bars are $3 a ton lower. Makers announce that they will close contracts against protections up to Jan. 15 and the specifications against these contracts must be received by April 30. There had been considerable hesitation about advancing reinforcing bars, evidently because of the price weakness in several districts.

Sheets

Buying at the new prices continues quite active and, if it continues at the present rate, leading producers soon will have their entire first quarter capacity sold.

Some mills have their schedules entirely filled on cold rolled sheets until March and others have little tonnage available for February. Orders for hot rolled and hot rolled annealed sheets can still be placed for delivery around Feb. 15. Enameling sheets are in about the same situation as cold rolled. Considerable new tonnage for March shipment was placed during the week by the motor car industry and by manufacturers of refrigerators and other household equipment. Motor car manufacturers have held up some shipments because of labor troubles.

. . . BOSTON . . .

. . . Warehouse prices are advanced as of Dec. 21.

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. . . Pig iron sold at higher prices recently announced.

BOSTON, Dec. 21.—Pig iron is selling for prompt and first quarter shipment, but in a small way, because most consumers are well covered into the early part of 1937. All furnaces are securing prices recently put into effect, giving the market a strong appearance. Shipments against orders formerly booked are fairly heavy. The New England foundry melt continues to increase slowly and now is greater than at any time since 1929.

All New England steel mills are operating at capacity, and have good backlogs of orders. Effective Dec. 21, local warehouses announced new prices, which show a general advance.

Steel fabricators are figuring more jobs than they have in several weeks, although tonnages are comparatively small. Most of the new tonnages are for bridges.

Beginning Jan. 1 the existing pension plan of the National Lead Co. will be revised to provide retirement incomes independent of and in addition to the old age benefits payable in the future by the Government under the Social Security Act, thereby providing for the 7000 employees a retirement benefit that will represent a substantial proportion of average earnings during the period of active service, according to Fred M. Carter, president.

. . BIRMINGHAM . .

. . . Operations at highest point in six years.

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. . . 15 of 18 blast furnaces in district active.

BIRMINGHAM, Dec. 21. — With heavy backlogs on hand, the largest in years, iron and steel operations are holding steadily to the highest points in six years. The wheels of industry in the Birmingham district are in full swing. For a few days last week 17 open-hearth units were in production; this week 16 are scheduled. Fifteen blast furnaces continue active, leaving only three regular stacks idle.

Other plants in the district, pipe, foundries, fabricators, building materials, etc., have also had liberal bookings, adding further to the upward swing.

Within the past 10 days additional rail tonnage has been booked, while the Bessemer, Ala., plant of the Pullman-Standard Car Mfg. Co. has received orders for 1250 more box cars, the Seaboard Air Line placing 1000 and the Southern Pacific, 250.

Gulf States Steel Co. is now operating its by-product coke plant for the first time since July, 1931.

This week the Federal Court will pass on the reorganization plan of the Woodward Iron Co.

. . . . BUFFALO . . . .

. . . Structural jobs being rushed into market.

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. . . Steel plant operations at unchanged rate.

BUFFALO, Dec. 21. — Open-hearth operation continues as last week, with Bethlehem operating 22 furnaces at its Lackawanna plant; Republic, seven, and Wickwire-Spencer Steel Co., two.

Considerable structural work is coming out, apparently with a view to obtaining coverage before the Dec. 31 deadline on the old prices. A 300-ton school job at Canisteo, N. Y., went to a Scranton fabricator. J. Dall, Jr., Ithaca, is low general bidder on the 175-ton Odessa, N. Y., high school job. Bids are to be taken Dec. 22 for a 500-ton building for the State Horticultural Society at Syracuse, and on Dec. 23 for 750 tons for regional market buildings in Syracuse. A Buffalo contractor is low on the Sheridan Drive grade school, Buffalo, to require 230 tons of structural, and bids will be taken this week on a 200-ton addition for the Iroquois Brewing Co. plant, Buffalo. Unusually good business for December in small reinforcing bar jobs is reported.

Warehouses report hot-rolled business very good, with November the best month for business since 1929.

Furnace interests are taking first quarter business, mostly for lots running up to 500 tons. Shipments are very good, with producers pressed to make the necessary deliveries.

REINFORCING STEEL

. . . Awards of 4095 tons —980 tons in new projects.

AWARDS

Camden, N. J., 1200 tons, Campbell Soup Co. building, to Bethlehem Steel Co.

Mifflin County, Pa., 200 tons, highway work, to Bethlehem Steel Co.

Chicago, 900 tons, second section of Jane Addams Housing project, to Inland Steel Co.

Dixon, Ill., 105 tons, grade school, to Joseph T. Ryerson & Son, Inc.

Milwaukee, 125 tons, Shorewood branch post office, to Inland Steel Co.

Helena, Mont., 152 tons, State pony truss bridge, to an unnamed bidder.

Ogden, Utah, 280 tons, tunnel lining in Zion National Park, to an unnamed bidder.

San Francisco, 100 tons, for United States Engineers, to Bethlehem Steel Co.

Los Angeles, 179 tons, San Pedro high school, to Soule Steel Co.

Los Angeles, 188 tons, State girder bridge, to an unnamed bidder.

Mare Island, Cal., 201 tons, material, Navy Department, Schedule No. 7473, to Soule Steel Co.

NEW REINFORCING BAR PROJECTS

Orford, N. H., 100 tons, State bridge.

Lexington, Ky., 180 tons, addition to Veterans' Hospital; bids taken Dec. 22.

Springfield, Mo., 390 tons, post office; bids taken Dec. 22.

Chicago, Ill., 180 tons, Abbott Laboratories.

Milwaukee, 130 tons, South Chase Avenue subway; Klug & Smith Co., Milwaukee, low bidder on general contract.

Santa Cruz, Cal., unstated tonnage, post office and jail; bids Jan. 7.

. . . . NEW YORK. . . .

. . . December sales will exceed November totals for some mills.

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. . . Heavy foreign demand features local market.

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. . . Distributers' resale price on New York concrete bars up $4.

NEW YORK, Dec. 21. — The deluge of orders in November has failed to halt an avid consumer demand for all grades of steel, and present indications are that for several of the large producers December will be a better month than November in the volume of new orders booked, and, by the same token, the best month of 1936. This applies particularly to mills whose capacity is heavily weighted with plates, shapes and bars. The delivery situation for strip and sheets has failed to improve, varying from 15 weeks for some mills to eight and nine weeks at other points, the result being that even important consumers are finding it impossible to place any additional sheet tonnage at low prices or even to get satisfactory deliveries on orders placed some weeks ago. A local railroad contacted most sellers in this area on Friday with 800 tons of sheets at fourth quarter prices.

Some new sheet and strip business is coming in at higher price levels for delivery late in the first quarter, and sellers point to this activity as evidence that the current bulge in demand is not of a pronounced speculative nature, but is backed up by a heavy and steady movement of steel products to the ultimate consumer. On the other hand, several mill representatives intimate that customers are placing heavier orders than would normally be the case in the belief that it is a safer policy to build up plant stocks and avoid any future danger of delay or cessation of shipments arising from possible labor troubles.

The bulk of current demand continues to come from users of plates, shapes and bars who are sending in orders for nearby shipment and also securing widespread protection on all identified projects. Undoubtedly this activity will continue until the end of December, when protection for all construction work and railroad car and locomotive building ends, and the total volume of material so contracted will probably be so heavy by that time that shipments will not be completed well into the second quarter, or even later in some instances.

Not only has competition from foreign steel disappeared from the local market, but importers are trying to fill some of their orders with domestic steel. Some very attractive inquiries of this nature are out, but they are being given scant consideration by domestic mills. Even more significant is the manner in which foreign consumers are attempting to buy in the American market. Last week Japan purchased a total of 6000 tons of sheet bars at a price higher than the first quarter domestic level, and this same country has bought about 35,000 tons of pig iron and has inquiries out for larger amounts. Several weeks ago Russia placed orders for over 15,000 tons of sheets and an unverified report has it that an additional purchase of 25,000 tons has been made.

Recent bookings in alloy steel have been very heavy, reflecting for the most part a general consumer anxiety to take full advantage of current price levels. The heavy tonnages now on books has given several sellers the best month of 1936, and additional tonnages are expected before new prices are fully applied.

Fresh demand for tin plate continues in exceptionally heavy volume, as can makers and packers anticipate their requirements.

In addition to the $4 advance on concrete bars, sellers have announced a $3 rise for cooperage or slack barrel hoops, effective for first quarter. The status of skelp is still uncertain in the absence of a definite price announcement.

Pig Iron

Foreign inquiry for upward of 100,000 tons of pig iron is estimated to have accumulated in the market. In addition to an earlier heavy commitment, Japan has purchased 20,000 tons from an Eastern Pennsylvania furnace and at least 6000 tons elsewhere. A local inquiry from China for between 5000 and 6000 tons is reported. Demand from domestic consumers is light by comparison, although recently one lot of 1000 tons was booked here at the new price. Sellers in general continue to pick up routine business of from carload to 200-ton lots. Between 6000 and 7000 tons of iron is definitely known to be tied up in the Erie barge canal without possibility of rescue until Spring. While no actual shortage in available supplies has developed as yet, winter prospects are none too bright. Further imports of a certain European brand, which has been relatively active in this market, are likely to be discontinued after present shipments are sold.

Reinforcing Bars

Effective Dec. 23, mills will quote billet bars $3 a ton higher to jobbers and $4 higher to the building trades. Bids on identified projects which are in prior to Dec. 23 will be given protection until Jan. 15, before which time definite contracts must be arranged.

Wheeling Steel Orders Two Roughing Mills

BLAW-KNOX CO., Pittsburgh, has been awarded a contract for two complete three-high sheet roughing mills with motors and controls to be installed at the Beach Bottom plant of the Wheeling Steel Corp. The mills are to be used for making breakdowns for sheet finishing mills and will be produced by the Lewis Foundry & Machine Co., subsidiary of the Blaw-Knox Co.

. . . Railroads authorized to make large expenditures.

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. . . Sheet users forced to place more orders.

ST. LOUIS, Dec. 21.—The Missouri Pacific Railway has asked Federal Court here for authority to spend $9,026,302 for betterments in 1937, including $2,527,610 for rails and other track materials; locomotives, $474,000; freight cars, $39,250 and improvements to existing equipment, $1,393,225; signals and interlocking plants, $681,705, and shop machinery and tools, $295,820.

The St. Louis-San Francisco railway has been authorized by the Federal Court to expend $5,357,353 for betterments in 1937. The items include 75 miles of 112-lb. rails, $822,231; tie plates for new rail, $135,528, and 800,000 tie plates and accessories, $200,000; locomotive work, $1,305,630, and freight car work, $1,290,770.

The United States circuit court of appeals authorized the St. Louis-Southwestern Railway to make expenditures for improvements out of current revenues, upholding District Judge Davis, who had overruled the objection of bondholders, who contended that trust certificates be issued and cash used to pay interest. The higher court granted an appeal, but directed the expenditures be made now.

Users of sheets, who find that they have underestimated their requirements when they placed orders for first quarter before the advance in price, are endeavoring to buy additional tonnages even at the higher quotations, but without success, as mills are reported to be sold up on their first-quarter output. Heavy buying of plates, shapes and bars continues.

Mississippi Valley Structural Steel Co. has been awarded 300 tons of shapes for turbine supports for the Cahokia plant of the Union Electric Light & Power Co., and Stupp Brothers will supply the 250 tons of shapes for the Vandeventer Avenue viaduct.

Melters in the St. Louis area are finding that they will require more pig iron than they thought when they placed their orders before the recent advance, and are offering additional tonnages at the same price as prevailed then, which melters are not accepting. Shipments continue at a high rate. Melt in the district shows no abatement, with the prospects that the holiday shutdown will be confined to Christmas and New Year's Day.

Cosden Pipe Line Co., Tulsa, Okla., has let contract to Sheehan Construction Co., Tulsa, for new 4-in. Lindewelded steel pipe line from Wewoka, Okla., oil district to Fitts Pool area, Fittstown, Okla., about 22 miles, for crude oil transmission. Cost over $150,000.

Phillips Petroleum Co., Bartlesville, Okla., plans 20-in. welded steel pipe line in High Street, Oklahoma City, Okla., about 6100 lin. ft., for natural gas transmission.

United States Engineer Office, Vicksburg, Miss., closes bids Dec. 28 for 6300 ft. of wrought steel pipe, ¼ to 5-in. diameter (Circular 156).

Kaplan, La., plans steel pipe line system for natural gas distribution. Bond issue of $25,000 has been voted.

Havre, Mont., will take bids soon for municipal steel pipe line system for natural gas distribution, including 6-in. welded steel pipe line to natural gas field area, about 10 miles, for supply main. Cost $163,636, in which amount financing has been arranged through Federal grant of $73,636 and bond issue of $90,000.

Peppers Gas Co., Enid, Okla., plans 8-in. welded steel pipe line in part of North Kelley Avenue, Oklahoma City, for crude oil transmission. Cost about $40,000. C. R. Koontz is company engineer.

Homer, La., plans steel pipe line system for gas distribution in connection with proposed municipal gas plant. Estimates of cost are being made.

Byrd-Frost, Inc., 1611 Hollywood Street, Dallas, Tex., D. Harold Byrd, president, plans welded steel pipe lines for crude oil transmission in connection with oil-drilling project in Talco, Tex., oil field area, Franklin and Titus counties, Tex., where company has acquired extensive acreage heretofore held by Gulf Oil Corp. Development will include over 100 new wells. Cost in excess of $1,500,000. Lucey Petroleum Co., Continental Building, Dallas, Tex., will carry out a similar program in same field, to cost close to like amount.

Pennsylvania Power & Light Co., Wilkes-Barre, Pa., plans 20-in. steel pipe line from gas plant on North Street, for replacement of present gas transmission line to river district of city. Cost over $35,000. Main offices are at Allentown, Pa.

Vicksburg, Miss., has awarded contract for 44 miles of 6⅝-in. pipe between Jackson and Vicksburg, Miss., to B & M Construction Co., Oklahoma City.

. . . Pig iron shipments at peak levels.

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. . . Steel-making operations are higher.

CINCINNATI, Dec. 21.—Activity in the district pig iron market is confirmed to clearing present commitments before January. While furnace policy toward contracts not completed on Dec. 31 is undetermined, the trade is proceeding on the theory that these will be canceled. This feeling is further strengthened by persistent reports of further advances in pig iron quotations in January. New business is not large, but shipments are at peak figures. Despite the heavy movement of material, foundry operations indicate that piling of iron will not be great. The melt holds at recent levels, with plants operating at an average of about 80 per cent.

First quarter sheet ordering is in good volume and reflects consumer desire to cover in anticipation of future needs. Buyers also appear to be eager to avoid delivery difficulties attendant upon the heavy demand this quarter. Price considerations are totally absent as buyers seek assurance of a steady flow of material. Current business is from widely diversified sources and reflects consumer optimism of good business at least through first quarter. Production schedules are unchanged at full capacity as mills work almost feverishly to clear the heavy fourth quarter bookings in time. Backlogs, however, indicate heavy rolling schedules well through January.

Open-hearth operations are up a few points to about 96 per cent, with 32 out of 32 furnaces operating.

Steel jobbers report a heavy demand as consumers seek material unobtainable from mills. Industrial bookings are noticeably heavy, although construction business is improving.

THIS WEEK'S MACHINE . . .TOOL ACTIVITIES. . .

. . . Orders for shop equipment continue in very large volume.

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. . . Price advances announced on a number of lines hasten placing of business.

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. . . December sales totals may be the highest of 1936.

Pittsburgh

THE last-minute rush to close contracts before the end of the year continues and brokers are busier than at any time in several years. It is a foregone conclusion that December business in the aggregate will be higher than in any other month in the year. Inquiries are still pouring in and the telephone is being used liberally to get orders on the books. No delivery promises are being made by dealers until factory confirmation is obtained. Customers are now apparently aware of the fact that, with the excessive demand for machine tools and certainty of higher prices, some attempt at anticipating their needs must be made. While the Christmas holiday season will slow up the recent tempo, it is expected that the period between Christmas and New Year's will find dealers actually swamped with work. Aside from the purchase of new heavy steel mill equipment, some companies are showing a disposition to be more liberal in their appropriations for maintenance machine tools. The steel mill equipment order placed in the past week consisted of two complete three-high sheet roughing mills with motors and controls.

New York

PRICE advances averaging about 10 per cent were announced in several lines last week. Most of the turret lathe manufacturers have increased prices, to be effective at various dates ranging from Dec. 8 to Dec. 21. A leading maker of shapers and radial drills will raise prices Dec. 24, while advances from two other companies prominent in those lines are not expected before the first of the year. Some other organizations are quoting present prices "subject to change without notice." Railroad equipment manufacturers are still active buyers, and the railroads themselves are expected to enter the market soon, since a number are entering upon extensive programs of construction and repairs in their own shops. General Motors has recently purchased a number of tools, mostly wood-working machinery, for its new plant in Linden, N. J. As little time was allowed for customers to cover before price increases were announced, a wave of buying has spread through sales offices here in the past two weeks. Inquiries are good, giving promise of continued activity.

Detroit

SALES of production machinery continue in surprisingly good volume. General Motors closed on the purchase of a fairly sizeable list of machinery for the manufacture of universal joints at the Saginaw steering gear plant. Initial purchase is for a pilot line and after the process sequences have been worked out, re-orders on identical or modified equipment are expected. It is also anticipated that the Mechanics Universal Joint Co., which supplies the bulk of General Motors requirements on universal joints, will tool up later on similar lines. Chrysler's Jefferson Avenue plant was in the market heavily last week for equipment to bolster up the line on component parts for the new six-cylinder engine used in Chrysler and DeSoto cars. Ford also continued to be an active factor in the market.

Small tool and cutter shops have been in the market for toolroom equipment in the past few weeks. Screw machines and standard machine tools have been moving in good volume to companies like the Burroughs Adding Machine Co., which has been engaged in a large rehabilitation program during the last several months and which is preparing to expand its manufacturing facilities at Plymouth, Mich., next spring. Some of the larger corporation shops are also buying toolroom equipment for the first time since the depression started. During this week and next, it is felt that further business will materialize from tool and die shops upon action of boards of directors of such companies, as they relate to machine tool expenditures in 1937.

Already there are appearing preliminary inquiries for production machinery for 1938 models. This is particularly true of cylinder block lines. Considerable interest seems to be taken in the matter of broaching both blocks and heads by the principal manufacturers, following Packard's successful installation last summer.

Cleveland

STIMULATED by advancing prices, machinery buyers are rushing to place orders before higher quotations become effective, resulting in a heavy volume of business, plenty of inquiry and more extended deliveries. Several additional manufacturers have made advances of approximately 10 per cent, effective Jan. 1. Late announcements of advances have come from some manufacturers of radial drills and shapers. Makers of some lines have not yet taken action on prices. Among these are lathe manufacturers who, it is reported, will consider advances early in January. Buying is mostly confined to small lots and is widely distributed. Purchases during the week included a dozen or more machines by the Firestone Tire & Rubber Co., Akron, Ohio, against its recent list.

Cincinnati

DECEMBER machinery business is following the precedent-breaking trend begun early in the year. Easing in demand, expected during the holiday period, has failed to materialize, and there are no indications of its imminence. Demand the past week was slightly better than during the preceding period, but no outstanding orders have been reported. European demand for millers, broaching machines, grinders and lathes is encouraging, while domestic ordering is undiminished. Heavy machinery is holding consumer interest. Plants are operating at an average of about 75 per cent, although orders would warrant a better production schedule. This conservatism is the result of management's desire to retain harmonious labor conditions.

St. Louis

MISSOURI Pacific Railway has asked the Federal Court here for authority to spend $9,026,302 for 1937 betterments, including $295,820 for shop machinery and tools, as follows: Missouri Pacific, $235,700; International-Great Northern, $50,000, and St. Louis, Brownsville & Mexico, $10,120. St. Louis-San Francisco railway has been authorized by the Federal Court here to expend $13,097 for the shop machinery listed in The Iron Age of Dec. 3.

Chicago

THE year end is bringing no recession either in sales or new inquiries. In fact, preliminary requests for figures by railroads indicate a fresh wave of buying from that source, which has not participated extensively in 1936 business. The Santa Fe is asking for a 24-in. by 12-ft. lathe. The Illinois Central contemplates buying the following: One 90-in. driving wheel quartering machine; one 90-in. locomotive wheel axle turning lathe; one 64-in. vertical boring machine; one 36-in. draw cut shaper; one 54-in. vertical boring machine; one 24-in. by 105-in. engine lathe; one horizontal boring, drilling and milling machine; one 4000-lb. steam drop hammer; one Miller cutter grinder, 6-in. to 30-in.; one plate shear, ½-in. by 10-in., mild steel; one 6-ft. radial drill. Deliveries continue to be pushed forward, and machine tool manufacturers find that under present conditions accurate predictions of delivery dates are seldom met with actual performance. Dealers report that 1936 is closing with total business about 25 per cent above the previous year.

FABRICATED STEEL

. . . Lettings decline to 23,855 tons from 29,920 tons a week ago.

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. . . New projects in better volume at 23,325 tons as against 16,705 tons last week.

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. . . Plate awards call for only 175 tons.

NORTH ATLANTIC STATES

Bucksport, Me., 125 tons, Maine Seaboard Paper Co. unit, to New England Structural Co., Everett, Mass.

Hollis, Me., 650 tons, Bar Mills bridge, to Boston Bridge Works, Inc., Cambridge, Mass.

Hollis-Buxton, Me., 575 tons, West Buxton bridge, to Harris Structural Steel Co., Plainfield, N. J.

New York, 245 tons, Kips Bay Health Center, to Harris Structural Steel Co.

New York, 375 tons, Gerard Avenue bridges for New York Central Railroad, to American Bridge Co.

Corona, N. Y., 1285 tons, bridge on Northern Boulevard, to American Bridge Co.

Brooklyn, 350 tons, building, F. W. Woolworth Co., to Joseph T. Ryerson & Son, Inc.

Glens Falls, N. Y., 115 tons, Montgomery Ward store, to Belmont Iron Works, Philadelphia.

Canisteo, N. Y., 300 tons, school, to Anthracite Bridge Co., Scranton, Pa.

Trenton, N. J., 675 tons, L. A. Young Spring & Wire Co. building, to Bethlehem Fabricators, Inc.

Weehawken, N. J., 330 tons, field office building, to Bethlehem Fabricators, Inc., Bethlehem, Pa.

Hammonton, N. J., 180 tons, crossing elimination, to Bethlehem Steel Co.

State of New Jersey, 380 tons, railroad lift bridge over Big Shark River, to Phoenix Bridge Co., Phoenixville, Pa.

Upper Darby, Pa., 120 tons, post office, to Bethlehem Fabricators, Inc.

Easton, Pa., 4700 tons, bridge across Delaware River, to Bethlehem Steel Co.

Lancaster, Pa., 135 tons, addition to Armstrong Cork building, to A. B. Rote Co.

State of Pennsylvania, 590 tons, bridge over Kiskimenitas River, to Fort Pitt Bridge Works Co.

Point of Rocks, Md., 1610 tons, highway bridge, to American Bridge Co.

Thurmont and Keymar, Md., 300 tons, bridges for Western Maryland Railroad, to Bethlehem Steel Co.

THE SOUTH

Huntington, W. Va., 185 tons, highway bridge, to Vincennes Bridge Co., Vincennes, Ind.

San Patricio County, Tex., 115 tons, to Virginia Bridge Co., Roanoke, Va.

Burnet and Llano Counties, Tex., 870 tons; 620 tons to Pittsburgh-Des Moines Steel Co., 250 tons to North Texas Iron & Steel Co.

Sunray, Tex., 5025 tons, plant for Witco Carbon Co., to Colorado Fuel & Iron Co.

CENTRAL STATES

Boston, Ind., 270 tons, rebuilding portion of Chesapeake & Ohio bridge, to Wisconsin Bridge & Iron Co., North Milwaukee.

Boscobel, Wis., 930 tons, highway bridge, to Midland Structural Steel Co., Cicero, Ill.

Lorain County, Ohio, 750 tons, grade crossing elimination bridge, to Burger Iron Co., Akron, Ohio.

Hammond, Ind., 215 tons, Lever Brothers service building, to Duffin Iron Co., Chicago.

Cook County, Ill., 755 tons, bridge, to Mississippi Valley Structural Steel Co., St. Louis.

Isanti County, Minn., 135 tons, bridge, to Minneapolis-Moline Power Implement Co., Minneapolis.

Cahokia, Ill., 300 tons, turbine supports for Union Electric Light & Power Co., to Mississippi Valley Structural Steel Co., St. Louis.

St. Louis, 250 tons, Vandeventer Avenue viaduct, to Stupp Brothers Bridge & Iron Co., St. Louis.

WESTERN STATES

Crowley County, Colo., 135 tons, Sugar City bridge, to Midwest Steel & Iron Works Co., Denver.

Cle Elum, Wash., 188 tons, State Bristol Fill bridge, to an unnamed interest.

Los Angeles, 240 tons, sound stage No. 16 for Twentieth Century-Fox Film Corp., to Bethlehem Steel Co.

Potholes, Cal., 440 tons, radial gates for Imperial Dam, to Lakeside Bridge & Steel Co., Milwaukee.

NEW STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

Turner, Me., 250 tons, State bridge.

Concord, N. H., 150 tons, State bridge.

New Boston, N. H., 125 tons, State bridge.

Haverhill, N. H., 100 tons, State bridge.

Webster, N. H., 100 tons, State bridge.

Boston, 750 tons, substructure for court house addition.

Taunton, Mass., 125 tons, State institution Nurses' Home.

Pepperell, Mass., 100 tons, State bridge.

Orford, N. H., 980 tons, Connecticut River bridge.

New Haven, Conn., 3500 tons, telephone building, Southern New England Telephone Co.

New York, 430 tons, test and annealing building, Washburn Wire Co.

New York, 1550 tons, grade crossing elimination, New York Central Railroad.

Brooklyn, 250 tons, barracks, etc., Floyd Bennett Field.

Yonkers, N. Y., 370 tons, grade crossing elimination, New York Central Railroad.

Syracuse, N. Y., 1000 tons, warehouses, Central New York Regional Authority.

Syracuse, N. Y., 500 tons, building for State Horticultural Society; bids taken Dec. 22.

Syracuse, 750 tons, regional market building; bids taken Dec. 23.

Tonawanda, N. Y., 230 tons, Sheridan Drive grade school; Metzger Construction Co., Buffalo, low bidder.

Buffalo, 200 tons, addition to Iroquois Brewery; bids this week.

Baltimore, 7000 tons, extensions to Middle River plant, Glenn L. Martin Co.

THE SOUTH

Ampthill, Va., 1500 tons, extensions to plant No. 2, E. I. duPont de Nemours.

Covington, Ky., 200 tons, elementary and junior high school.

State of Alabama, 300 tons, service bay structure, Tennessee Valley Authority, Pickwick Landing power house.

CENTRAL STATES

Detroit, 268 tons, railroad viaduct underpinning, Section 8, PWA project.

Milwaukee Road, 1200 tons, bridges.

Milwaukee, 450 tons, South Chase Avenue subway; Klug & Smith Co., Milwaukee, low bidder on general contract.

Kenosha, Wis., 135 tons, Wilmot bridge; S. J. Groves & Son Co., Minneapolis, low bidder on general contract.

WESTERN STATES

Colorado Springs, Colo., 500 tons, Bijou Street viaduct.

Tillamook County, Ore., 400 tons, Necarney Creek viaduct.

Pacific County, Wash., 350 tons, Nasel River bridge.

FABRICATED PLATES

AWARDS

Newark, N. J., 175 tons, eight grain bins for Kreuger Brewing Co., to Dover Boiler Works.

NEW PROJECTS

Everett, Wash., 6000 tons, water pipe line from Lake Champlain; Western Pipe & Steel Co., low bidder.

SHEET PILING

AWARDS

New York, 825 tons, Sheepshead Bay bulkhead, to Bethlehem Steel Co.

Munroe, La., 1530 tons, concrete and steel levee wall on Ouchita River, United States Engineers Office, Vicksburg, Miss., to Jones & Laughlin Steel Corp.

NEW INQUIRIES

Flushing Bay, N. Y., 1800 tons, bulkhead; bids taken Dec. 22.

New York, 1800 tons, tide gate and dam, contract No. 4, city of New York; bids Dec. 30.

Detroit, 2500 tons, sewer interceptor, section 8, PWA project.

. . .NON-FERROUS. . .

. . . Lead prices advance to 6c. level at New York; spelter rises $4 more a ton.

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. . . Domestic copper still in demand; foreign activity strengthens.

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. . . Tin market very dull.

NEW YORK, Dec. 21.—A good demand for copper for domestic consumption continues to lend firmness to this market, although, as recently announced, prices were advanced on Dec. 14 to 11.00c. a lb., Connecticut Valley, for electrolytic metal. While sales volume subsequent to last Thursday (Dec. 17) has not been accurately determined, through that period monthly turnover amounted to 87,793 tons. Recent announcement has been that domestic production is increasing and that several heretofore inactive producing units are again entering the competition. Sustained foreign activity in the red metal has caused the export price to advance sharply today to as high as 11.40c. a lb., European ports.

The Week's Prices. Cents Per Pound for Early Delivery

	Dec. 16	Dec. 17	Dec. 18	Dec. 19	Dec. 21
Electrolytic copper, Conn.*	10.50	10.50	10.50	10.50	11.00
Lake copper, N. Y.	10.62½	10.62½	10.62½	10.62½	11.12½
Straits tin, spot, New York	52.85	52.50	52.25	...	52.00
Zinc, East St. Louis	5.35	5.45	5.45	5.45	5.45
Zinc, New York†	5.72½	5.82½	5.82½	5.82½	5.82½
Lead, St. Louis	5.35	5.35	5.35	5.35	5.85
Lead, New York	5.50	5.50	5.50	5.50	6.00

* Delivered Connecticut Valley; price ¼c. lower delivered in New York.
† Includes emergency freight charge.
Aluminum, virgin 99 per cent plus 19.00c.-21.00c. a lb. delivered.
Aluminum No. 12 remelt No. 2 standard, in carloads, 17.00c. a lb. delivered.
Nickel, electrolytic, 35c. to 36c. a lb. base refinery, in lots of 2 tons or more.
Antimony, Asiatic, 12.62½c. a lb., New York.
Quicksilver, $88.50 to $92.00 per flask of 76 lb.
Brass ingots, commercial 85-5-5-5, 10.65c. a lb., delivered; in Middle West ¼c. a lb. is added on orders for less than 40,000 lb.

From New York Warehouse

Delivered Prices, Base per Lb.

Tin, Straits pig	52.75c. to 53.75c.
Tin, bar	54.75c. to 55.75c.
Copper, Lake	12.00c. to 13.00c.
Copper, electrolytic	12.00c. to 13.00c.
Copper, castings	11.25c. to 12.25c.
*Copper sheets, hot-rolled	18.25c.
*High brass sheets	16.37½c.
*Seamless brass tubes	18.62½c.
*Seamless copper tubes	18.75c.
*Brass rods	14.37½c.
Zinc, slabs	6.75c. to 7.75c.
Zinc, sheets (No. 9), casks, 1200 lb. and over	10.75c.
Lead, American pig	6.25c. to 7.25c.
Lead, bar	7.25c. to 8.25c.
Lead, sheets, cut	8.75c.
Antimony, Asiatic	13.00c. to 14.00c.
Alum., virgin, 99 per cent plus	23.30c.
Alum., No. 1 for remelting, 98 to 99 per cent	18.50c. to 20.00c.
Solder, ½ and ½	31.50c. to 32.50c.
Babbitt metal, commercial grades	25.00c. to 65.00c.

* These prices, which are also for delivery from Chicago and Cleveland warehouses, are quoted with 33⅓ per cent allowed off for extras, except copper tubes and brass rods, on which allowance is 40 per cent.

From Cleveland Warehouse

Delivered Prices per Lb.

Tin, Straits pig	54.50c.
Tin, bar	56.50c.
Copper, Lake	11.50c. to 11.75c.
Copper, electrolytic	11.50c. to 11.75c.
Copper castings	11.25c. to 11.50c.
Zinc, slabs	6.50c. to 6.75c.
Lead, American pig	6.10c. to 6.30c.
Lead, bar	8.50c.
Antimony, Asiatic	15.50c.
Babbitt metal, medium grade	20.50c.
Babbitt metal, high grade	61.00c.
Solder, ½ and ½	32.50c.

Old Metals, Per Lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators, and selling prices are those charged to consumers after the metal has been prepared for their uses. (All prices are nominal.)

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	8.50c.	9.25c.
Copper, hvy. and wire	8.37½c.	8.87½c.
Copper, light and bottoms	7.62½c.	8.12½c.
Brass, heavy	5.12½c.	5.75c.
Brass, light	4.25c.	5.00c.
Hvy. machine composition	7.50c.	8.00c.
No. 1 yel. brass turnings	6.25c.	6.75c.
No. 1 red brass or compos. turnings	7.00c.	7.50c.
Lead, heavy	4.50c.	4.87½c.
Sheet aluminum	13.25c.	14.75c.
Zinc	2.75c.	3.12½c.
Cast aluminum	12.12½c.	13.25c.

Lead

Rising foreign prices have further stimulated the domestic market, and lead at New York now sells for 6.00c. As usual St. Joseph Lead Co. was the first to advance, raising its base quotation $2 a ton on Saturday to 5.60c. a lb., New York, and 5.45c., St. Louis. The Smelting company did not follow at that time, but increased its quotation $10 a ton today to coincide with an $8 increase by St. Joseph Lead, thus establishing the market uniformly at 6.00c., New York, and 5.85c., St. Louis. During this action demand has persisted, and probably 20,000 to 30,000 tons of lead has been sold over the past nine to ten days.

Zinc

Upward trend in prices which featured the previous week's opening continued through Dec. 17, the market rising $2 a ton in successive stages until it reached 5.45c., East St. Louis basis, on the date noted. Heavy demand in combination with restricted offerings has been responsible for this movement. While no further increase has occurred since Dec. 17, the undertone continues bullish. Spelter for second quarter delivery is priced $2 a ton higher than prompt quotations, or at 5.55c., East St. Louis, the 5.45c. level applying to commitments for spot and first quarter shipment. Currently, turnover in the market is fairly active. One producer is asking between 5.50c. and 5.55c. a lb. on any business taken, whether for first or second quarter shipment.

Tin

Irrespective of activity in other metals, tin has recently attracted little interest. Absence of demand has accordingly caused the market to decline, and New York spot Straits metal is priced today at 52.00c. a lb., contrasted with 52.85c. at the middle of last week. Importers and dealers expect very little turnover to develop until after the year-end. Standard metal quotations in London this morning were £232 15s. on both cash and three-months. The price in the East was £236.

IRON AND STEEL SCRAP

. . . Composite up 42c. to $17.75, highest level since Jan. 13, 1925.

o o o

. . . New sales reported at Pittsburgh and in Youngstown area.

FOR the second consecutive week, scrap prices have moved sharply upward. The new composite, at $17.75 a gross ton, is up 42c. from a week ago; it exceeds the 1929 high level by 17c. and is the highest point reached since Jan. 13, 1925, at which time the average heavy melting steel price was at $20.83.

A combination of unprecedented unseasonal steel producing activity coupled with impending delays in preparation and shipment due to winter weather are responsible for the current buoyancy in steel-making scrap. Sellers are refusing to take heavy forward orders, and the smaller orders that are taken are in many cases covered at a profit only with considerable difficulty. Although some good-sized tonnages have been placed during the past fortnight at Pittsburgh and in the Cleveland-Lorain area, other steel consuming centers report no great amount of buying activity. Evidently sellers are confident that additional heavy demand must soon appear, for prices are being slowly advanced in sympathy with more active markets and mill offers below these levels are receiving little consideration.

Detroit

Largely in sympathy with Pittsburgh and Youngstown markets, the Detroit market has risen $1 a ton average on principal listings. There has been practically no buying on the part of local mills to speak of. The Fisher Body list issued last week brought $15.25 for hydraulic bundles, $1.25 rise over previous quotation.

Pittsburgh

In addition to high operations in local steel mills, severe winter weather over the week-end has contributed to further strength in the market. In the past week, sales of No. 1 steel at $19.50 have been made into consumption, and sales of railroad steel have been reported at $20. Meanwhile, little activity is expected during the coming week owing to the Christmas holidays, as most scrap sales offices will be closed from Thursday night until Monday morning. Brokers are busy covering orders taken during the recent sharp rise and are now paying $18.75 and $19 a ton for No. 1. Scrap is by no means plentiful, although the higher quotations are having their effect on bringing out supplies. Heavy demand for railroad specialties has brought further increases of $1 a ton.

Cleveland

With mounting prices, the market has developed a very excited condition. Local quotations, which advanced moderately a week ago, have moved up sharply, feeling the full effect of the upward trend at Pittsburgh and Youngstown. Steel-making grades here have been advanced $1.25 a ton and billet crops and short rails as much as $3 a ton. A Valley consumer has paid $18.50 for No. 1 steel and $17.50 for No. 2, the price on the No. 1 grade being 25c. higher than another Valley producer paid a few days previously. A Lorain consumer has purchased a small tonnage of No. 1 at a reported price of $18. Blast furnace grades are up 50c. a ton, brokers paying $12.50 to fill old orders.

St. Louis

In an effort to bring out scrap iron to cover a heavy short interest, dealers have advanced their prices on most items on the list from 50c to as much as $1.50 a ton. No sales were made during the week, and none is expected until Jan. 15.

Cincinnati

While the district mill purchases were not great the past week, activity elsewhere attracted fairly substantial amounts of scrap from this area. Dealers, eager to ride the swell, bid strongly for available material thereby pushing offers up 25c to 75c. Material is slightly restricted, but so far no serious shortage is expected.

Boston

Prices have been moved up further with a quickening in demand. Prices for bundled skeleton have been exceptional, and currently are $1.25 to $1.30 higher than a week ago and less than $1 a ton under prices for No. 1 steel. Regular steel turnings are $1.10 a ton higher, while short turnings suitable for shoveling command a premium of 50c a ton or more. Dealers are paying $12.40 a ton on cars for No. 1 steel, an advance of 50c for shipment to Pennsylvania. Exporters have lifted prices 25c a ton for heavy melting steel, and shipments recently have been made to Japan, Germany, Italy, Holland and England.

Philadelphia

Although heavy melting steel prices are somewhat nominal in the absence of sizable test sales, an increase of 50c. per ton is being recorded as a reflection of higher broker bids and the general inability of mills to place orders under $16.50. Frankford Arsenal sold 500 tons of machine shop turnings to a broker last week at a price believed to be at least $11.20 a ton, although the exact figure has not been divulged.

Buffalo

With the market stiffening at outside points, dealers here were of the opinion that the next sizable sale in this area would be a tonnage of No. 2 steel to a local mill, and that the price would be at least $16. This material could be sold in quantity now at $15.50, but dealers are paying as much to supply an old order. The largest district consumer is expected to come into the market between Christmas and Jan. 1. All grades of cast scrap are strong and some sales have been made.

Chicago

Strength shown a week ago is still in evidence, though brokers have not snapped mill resistance except on a few scattered and small tonnages. The trend of the market is balanced between two major influences. The question of supplies is one which is not serious right now, but buyers and sellers alike cannot get their minds off the subject. To reach farther afield for more scrap would run up prices. On the other hand, brokers are nearly caught up with mill orders and it is possible, if mills can hold out, that scrap on wheels may have to be placed, at which time buyers would have the advantage when talking prices.

New York

Reflecting the buoyancy of the eastern Pennsylvania and Pittsburgh markets, prices here have moved up 50c. a ton on important grades. Brokers are obtaining some No. 1 and No. 2 heavy melting steel at $12.50 and $11.50 respectively for shipment against old orders, but the flow of material at these prices is somewhat restricted in view of the general tendency of dealers to hold on to accumulations in anticipation of even higher bids.

Iron and Steel Scrap Prices

PITTSBURGH

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel.	$19.00 to $19.50
No. 2 hvy mltng. steel.	17.50 to 18.00
No. 2 RR. wrought	19.00 to 19.50
Scrap rails	19.25 to 19.75
Rails, 3 ft. and under	21.50 to 22.00
Comp. sheet steel	19.00 to 19.50
Hand. bundled sheets	18.00 to 18.50
Hvy. steel axle turn.	17.50 to 18.00
Machine shop turn.	13.50 to 14.00
Short shov. turn.	14.00 to 14.50
Mixed bor. & turn.	13.00 to 13.50
Cast iron borings	13.50 to 14.00
Cast iron carwheels	17.50 to 18.00
Hvy. breakable cast	14.50 to 15.00
No. 1 cast	17.00 to 17.50
RR. knuckles & cplrs.	23.00 to 23.50
Rail coil & leaf springs	23.00 to 23.50
Rolled steel wheels	23.00 to 23.50
Low phos. billet crops.	23.00 to 23.50
Low phos. sh. bar	22.00 to 22.50
Low phos. punchings	21.50 to 22.00
Low phos. plate scrap.	21.50 to 22.00
Steel car axles	21.50 to 22.00

CLEVELAND

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel.	$17.00 to $17.50
No. 2 hvy. mltng. steel.	16.00 to 16.50
Comp. sheet steel	16.50 to 17.00
Light bund. stampings	16.50 to 17.00
Drop forge flashings	16.00 to 16.50
Machine shop turn.	11.50 to 12.00
Short shov. turn.	12.00 to 12.50
No. 1 busheling	16.00 to 16.50
Steel axle turnings	13.00 to 13.50
Low phos. billet crops	22.00 to 22.50
Cast iron borings	12.00 to 12.50
Mixed bor. & turn.	12.00 to 12.50
No. 2 busheling	12.00 to 12.50
No. 1 cast	18.00 to 18.50
Railroad grate bars	12.00 to 12.50
Stove plate	10.00 to 10.50
Rails under 3 ft.	22.00 to 22.50
Rails for rolling	18.00 to 18.50
Railroad malleable	18.00 to 18.50
Cast iron carwheels	18.50 to 19.00

PHILADELPHIA

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel.	$16.00 to $16.50
No. 2 hvy. mltng. steel.	14.50 to 15.00
Hydraulic bund., new.	15.75 to 16.25
Hydraulic bund., old.	13.50 to 14.00
Steel rails for rolling	17.00 to 17.50
Cast iron carwheels	17.00 to 17.50
Hvy. breakable cast	16.00 to 16.50
No. 1 cast	17.00 to 17.50
Stove plate (steel wks.)	13.00 to 13.50
Railroad malleable	16.50 to 17.00
Machine shop turn.	10.50 to 11.00
No. 1 blast furnace	10.00 to 10.50
Cast borings	10.00 to 10.50
Heavy axle turnings	.... 14.50
No. 1 low phos. hvy.	20.00 to 20.50
Couplers & knuckles	20.50 to 21.00
Rolled steel wheels	20.50 to 21.00
Steel axles	20.50 to 21.00
Shafting	21.00 to 21.50
No. 1 RR. wrought	16.00 to 16.50
Spec. iron & Steel pipe	14.50 to 15.00
Bundled sheets	14.00 to 14.50
No. 1 forge fire	14.50 to 15.00
Cast borings (chem.)	10.50 to 13.00

CHICAGO

Delivered to Chicago district consumers:

	Per Gross Ton
Hvy. mltng. steel	$17.50 to $18.00
Auto. hvy. mltng. steel.	14.75 to 15.25
Alloy free	15.75 to 16.25
Shoveling steel	17.50 to 18.00
Hydraul. comp. sheets.	16.75 to 17.25
Drop forge flashings	14.50 to 15.00
No. 1 busheling	15.00 to 15.50
Rolled carwheels	19.00 to 19.50
Railroad tires, cut	19.00 to 19.50
Railroad leaf springs	19.00 to 19.50
Axle turnings	16.00 to 16.50
Steel coup. & knuckles	19.00 to 19.50
Coil springs	22.00 to 22.50
Axle turn. (elec.)	16.50 to 17.00
Low phos. punchings	21.00 to 21.50
Low phos. plates, 12 in. and under	21.00 to 21.50
Cast iron borings	9.50 to 10.00
Short shov. turnings	11.00 to 11.50
Machine shop turn.	8.50 to 9.00
Rerolling rails	17.50 to 18.00
Steel rails under 3 ft.	18.50 to 19.00
Steel rails under 2 ft.	20.50 to 21.00
Angle bars, steel	19.25 to 19.75
Cast iron carwheels	18.00 to 18.50
Railroad malleable	19.50 to 20.00
Agric. malleable	15.50 to 16.00
	Per Net Ton
Iron car axles	20.50 to 21.00
Steel car axles	$19.50 to $20.00
No. 1 RR. wrought	15.00 to 15.50
No. 2 RR. wrought	15.75 to 16.25
No. 2 busheling, old	6.75 to 7.25
Locomotive tires	14.00 to 14.50
Pipes and flues	11.00 to 11.50
No. 1 machinery cast	15.00 to 15.50
Clean auto. cast	14.00 to 14.50
No. 1 railroad cast	14.00 to 14.50
No. 1 agric. cast	11.50 to 12.00
Stove plate	8.75 to 9.25
Grate bars	11.50 to 12.00
Brake shoes	11.50 to 12.00

BUFFALO

Per gross ton, f.o.b. consumers' plants:

No. 1 hvy. mltng. steel.	$16.00 to $16.50
No. 2 hvy. mltng. steel.	15.00 to 15.50
Scrap rails	16.00 to 16.50
New hy. b'ndled sheets	15.00 to 15.50
Old hydraul. bundles	13.00 to 13.50
Drop forge flashings	15.00 to 15.50
No. 1 busheling	15.00 to 15.50
Hvy. axle turnings	10.50 to 11.00
Machine shop turn.	9.50 to 10.00
Knuckles & couplers	19.50 to 20.00
Coil & leaf springs	19.50 to 20.00
Rolled steel wheels	19.50 to 20.00
Low phos. billet crops.	19.50 to 20.00
Short shov. turnings	10.50 to 11.00
Mixed bor. & turn.	10.50 to 11.00
Cast iron borings	10.50 to 11.00
No. 2 busheling	11.00 to 11.50
Steel car axles	17.00 to 17.50
Iron axles	12.00 to 12.50
No. 1 machinery cast	16.00 to 16.50
No. 1 cupola cast	15.00 to 15.50
Stove plate	13.00 to 13.50
Steel rails under 3 ft.	17.50 to 18.00
Cast iron carwheels	15.50 to 16.00
Railroad malleable	17.00 to 18.00
Chemical borings	10.50 to 11.00

BIRMINGHAM

Per gross ton delivered to consumer:

Hvy. melting steel	$12.50 to $13.00
Scrap steel rails	12.50 to 13.00
Short shov. turnings	.... 8.00
Stove plate	.... 8.50
Steel axles	.... 15.00
Iron axles	.... 15.00
No. 1 RR. wrought	.... 10.00
Rails for rolling	.... 14.00
No. 1 cast	.... 13.50
Tramcar wheels	.... 13.00

ST. LOUIS

Dealer's buying prices per gross ton delivered to consumer:

Selected hvy. steel	$16.00 to $16.50
No. 1 hvy. melting	15.50 to 16.00
No. 2 hvy. melting	14.25 to 14.75
No. 1 locomotive tires	15.00 to 15.50
Misc. stand.-sec. rails	16.25 to 16.75
Railroad springs	18.25 to 18.75
Bundled sheets	9.50 to 10.00
No. 2 RR. wrought	15.50 to 16.00
No. 1 busheling	8.50 to 9.00
Cast bor. & turn.	5.50 to 6.00
Rails for rolling	17.25 to 17.75
Machine shop turn.	4.00 to 4.50
Heavy turnings	10.50 to 11.00
Steel car axles	19.00 to 19.50
Iron car axles	19.50 to 20.00
No. 1 RR. wrought	13.50 to 14.00
Steel rails under 3 ft.	17.00 to 17.50
Steel angle bars	16.25 to 16.75
Cast iron carwheels	15.00 to 15.50
No. 1 machinery cast	12.50 to 13.00
Railroad malleable	15.50 to 16.00
No. 1 railroad cast	12.50 to 13.00
Stove plate	7.50 to 8.00
Agricul. malleable	12.50 to 13.00
Grate bars	9.75 to 10.25
Brake shoes	12.25 to 12.75

CINCINNATI

Dealers' buying prices per gross ton:

No. 1 hvy. mltng. steel.	$15.00 to $16.00
No. 2 hvy. mltng. steel.	12.75 to 13.25
Scrap rails for mltng.	15.50 to 16.00
Loose sheet clippings.	9.50 to 10.00
Bundled sheets	11.50 to 12.00
Cast iron borings	7.50 to 8.00
Machine shop turns	8.50 to 9.00
No. 1 busheling	12.00 to 12.50
No. 2 busheling	7.50 to 8.00
Rails for rolling	16.00 to 16.50
No. 1 locomotive tires	13.75 to 14.25
Short tails	18.75 to 19.25
Cast iron carwheels	14.75 to 15.25
No. 1 machinery cast	15.75 to 16.25
No. 1 railroad cast	14.75 to 15.25
Burnt cast	10.75 to 11.25
Stove plate	10.75 to 11.25
Agricult. malleable	14.75 to 15.25
Railroad malleable	16.25 to 16.75

DETROIT

Dealers' buying prices per gross ton:

No. 1 hvy. mltng. steel.	$14.00 to $14.50
No. 2 hvy. mltng. steel.	13.25 to 13.75
Borings and turnings.	10.00 to 10.50
Long turnings	9.50 to 10.00
Short shov. turnings	10.50 to 11.00
No. 1 machinery cast	15.00 to 15.50
Automotive cast	15.00 to 15.50
Hydraul. comp. sheets.	14.75 to 15.25
Stove plate	8.50 to 9.00
New factory bushel	14.00 to 14.50
Old No. 2 busheling	9.00 to 9.50
Sheet clippings	11.25 to 11.75
Flashings	13.50 to 14.00
Low phos. plate scrap.	15.00 to 15.50

CANADA

Dealers' buying prices per gross ton:

	Toronto	Montreal
No. 1 hvy. mltng. steel.	$10.75	$10.50
No. 2 hvy. mltng. steel.	9.75	9.25
Mixed dealers steel	7.75	7.75
Scrap pipe	6.75	6.50
Steel turnings	4.25	4.25
Cast iron turnings	4.75	4.50
Machinery cast	11.75	11.00
Dealers cast	10.75	10.00
Stove plate	7.25	6.75

YOUNGSTOWN

Per gross ton delivered to consumer:

No. 1 hvy. mltng. steel.	$17.75 to $18.25
Hydraulic bundles	17.00 to 17.50
Machine shop turn.	12.00 to 12.50

NEW YORK

Dealers' buying prices per gross ton:

No. 1 hvy. mltng. steel.	$12.00 to $12.50
No. 2 hvy. mltng. steel.	10.00 to 11.50
Hvy. breakable cast	11.75 to 12.50
No. 1 machinery cast.	12.50 to 13.00
No. 2 cast	11.00 to 11.50
Stove plate	9.50 to 9.75
Steel car axles	17.00 to 18.00
Shafting	16.00 to 17.00
No. 1 RR. wrought	12.00 to 12.50
No. 1 wrought long	11.00 to 11.50
Spec. iron & steel pipe	10.50 to 11.00
Forge fire	9.50 to 10.00
Rails for rolling	13.50 to 14.00
Short shov. turnings	6.00 to 6.50
Machine shop turn.	6.00 to 6.50
Cast borings	6.00 to 6.50
No. 1 blast furnace	6.00 to 6.50
Cast borings (chem.)	10.00 to 11.00
Unprepar. yard scrap.	6.00 to 6.50

Per gross ton, delivered local foundries:

No. 1 machn. cast	$14.00 to $14.50
No. 1 hvy. cast cupola.	11.50 to 12.00
No. 2 cast	10.50 to 11.00

Add 25c. to 50c. above quotations to secure North Jersey prices.

BOSTON

Dealers' buying prices per gross ton:

No. 1 hvy. mltng. steel.	$12.40 to $12.90
Scrap rails	12.50 to 13.00
No. 2 steel	10.40 to 10.50
Breakable cast	10.50 to 10.75
Machine shop turn.	7.50 to 8.15
Unmixed bor. & turn.	6.00 to 6.25
Bund. skeleton long	11.50 to 11.60
Shafting	16.50 to 16.75
Cast bor. chemical	6.00 to 7.00

Per gross ton delivered consumers' yards:

Textile cast	$13.00 to $13.75
No. 1 machine cast	.... 13.50
Stove plate	9.50 to 10.00

EXPORT

Dealers' buying prices per gross ton:

New York, delivered alongside barges

No. 1 hvy. mltng. steel.	.... $11.50
No. 2 hvy. mltng. steel.	.... 10.50
No. 2 cast	.... 10.50
Stove plate	.... 9.50
Rails (scrap)	$10.25 to 11.50

Boston on cars at Army Base or Mystic Wharf

No. 1 hvy. mltng. steel.	$12.50 to $12.60
No. 2 hvy. mltng. steel	11.50 to 11.60
Rails (scrap)	12.50 to 12.75
Stove plate	7.75 to 8.00
Machine shop turn.	6.25 to 6.50

New Orleans, on cars at Stuyvesant Dock

No. 1 hvy. mltng. steel.	$12.60 to $12.75
No. 2 hvy. mltng. steel.	11.60 to 11.75

Los Angeles, on cars or trucks at local piers

No. 1 hvy. mltng. steel.	$10.50 to $11.00
Compressed bundles	8.50 to 9.00

PRICES ON FINISHED AND SEMI-FINISHED IRON AND STEEL

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham. Prices at Duluth are $2 a ton higher, and delivered Detroit $3 higher.

	Per Gross Ton
Rerolling	$32.00 to $34.00
Forging quality	39.00 to 40.00

Sheet Bars

F.o.b. Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open-hearth or Bessemer	$32.00 to $34.00

Skelp

F.o.b. Pittsburgh, Chicago, Youngstown, Buffalo, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.80c. to 1.90c.

Wire Rods
(No. 5 to 15/32 in.)

	Per Gross Ton
F.o.b. Pittsburgh or Cleveland	$43.00
F.o.b. Chicago, Youngstown or Anderson, Ind.	44.00
F.o.b. Worcester, Mass.	45.00
F.o.b. Birmingham	46.00
F.o.b. San Francisco	52.00
F.o.b. Galveston	49.00

BARS, PLATES, SHAPES

Iron and Steel Bars

Soft Steel

	Base per Lb.
F.o.b. Pittsburgh	2.05c. to 2.20c.
F.o.b. Chicago or Gary	2.10c. to 2.25c.
F.o.b. Duluth	2.20c. to 2.35c.
Del'd Detroit	2.20c. to 2.35c.
F.o.b. Cleveland	2.10c. to 2.25c.
F.o.b. Buffalo	2.15c. to 2.30c.
Del'd Philadelphia	2.36c. to 2.51c.
Del'd New York	2.40c. to 2.55c.
F.o.b. Birmingham	2.20c. to 2.35c.
F.o.b. cars dock Gulf ports	2.45c. to 2.60c.
F.o.b. cars Pacific ports	2.60c. to 2.75c.

Rail Steel
(For merchant trade)

F.o.b. Pittsburgh	1.90c. to 2.05c.
F.o.b. Cleveland, Chicago, Gary or Moline, Ill.	1.95c. to 2.10c.
F.o.b. Buffalo	2.00c. to 2.15c.
F.o.b. Birmingham	2.05c. to 2.20c.
F.o.b. cars dock Gulf ports	2.30c. to 2.45c.
F.o.b. cars dock Pacific ports	2.45c. to 2.60c.

Billet Steel Reinforcing
(Straight lengths as quoted by distributors)

F.o.b. Pittsburgh	2.05c. to 2.25c.
F.o.b. Buffalo, Cleveland, Youngstown, Chicago, Gary or Birmingham	2.10c. to 2.30c.
Del'd Detroit	2.20c. to 2.40c.
F.o.b. cars dock Gulf ports	2.45c. to 2.65c.
F.o.b. cars dock Pacific ports	2.45c. to 2.65c.

Rail Steel Reinforcing
(Straight lengths as quoted by distributors)

F.o.b. Pittsburgh	1.90c. to 2.10c.
F.o.b. Buffalo, Cleveland Youngstown, Chicago, Gary or Birmingham	1.95c. to 2.15c.
F.o.b. cars dock Gulf ports	2.30c. to 2.50c.
F.o.b. cars dock Pacific ports	2.30c. to 2.50c.

Iron

F.o.b. Chicago	1.80c.
F.o.b. Pittsburgh (refined)	2.10c.
Delivered New York	2.05c.
Delivered Philadelphia	2.10c.

Cold Finished Bars and Shafting*

	Base per Lb.
F.o.b. Pittsburgh	2.35c. to 2.55c.
F.o.b. Cleveland, Chicago and Gary	2.40c. to 2.60c.
F.o.b. Buffalo	2.45c. to 2.65c.
Del'd Detroit	2.50c. to 2.70c.
Del'd eastern Michigan	2.55c. to 2.75c.

* In quantities of 10,000 to 19,999 lb.

Plates

	Base per Lb.
F.o.b. Pittsburgh	1.90c. to 2.05c.
F.o.b Chicago or Gary	1.95c. to 2.10c.
Del'd Cleveland	2.095c. to 2.245c.
F.o.b. Coatesville or Spar. Pt.	2.00c. to 2.15c.
Del'd Philadelphia	2.09c. to 2.24c.
Del'd New York	2.19c. to 2.34c.
F.o.b. Birmingham	2.05c. to 2.20c.
F.o.b. cars dock Gulf ports	2.30c. to 2.45c.
F.o.b. cars dock Pacific ports	2.45c. to 2.60c.
Wrought iron plates, f.o.b. Pittsburgh	3.20c.

Floor Plates

F.o.b. Pittsburgh	3.45c.
F.o.b. Chicago	3.50c.
F.o.b. Coatesville	3.55c.
F.o.b. cars dock Gulf ports	3.85c.
F.o.b. cars dock Pacific ports	4.00c.

Structural Shapes

	Base per Lb.
F.o.b. Pittsburgh	1.90c. to 2.05c.
F.o.b. Chicago	1.95c. to 2.10c.
Del'd Cleveland	2.095c. to 2.245c.
F.o.b. Buffalo or Bethlehem	2.00c. to 2.15c.
Del'd Philadelphia	2.115c. to 2.265c.
Del'd New York	2.1625c. to 2.3125c.
F.o.b. Birmingham (standard)	2.05c. to 2.20c.
F.o.b. cars dock Gulf ports	2.30c. to 2.45c.
F.o.b. cars dock Pacific ports	2.45c. to 2.60c.

Steel Sheet Piling

	Base per Lb.
F.o.b. Pittsburgh	2.25c. to 2.40c.
F.o.b. Chicago or Buffalo	2.35c. to 2.50c.
F.o.b. cars dock Gulf or Pacific Coast ports	2.70c. to 2.85c.

RAILS AND TRACK SUPPLIES

F.o.b. Mill

Standard rails, heavier than 60 lb. per gross ton	$39.00
Angle bars, per 100 lb.	2.55c. to 2.70c.

F.o.b. Basing Points

Light rails (from billets) per gross ton	$35.00
Light rails (from rail steel) per gross ton	34.00

	Base per 100 Lb.
Spikes	2.75c. to 2.90c.
Tie plates, steel	2.00c. to 2.10c.
Tie plates, Pacific Coast ports	2.10c. to 2.20c.
Track bolts, to steam railroads	3.75c. to 4.00c.
Track bolts, to jobbers, all sizes (per 100 counts) 70 per cent off list	

Basing points on light rails are Pittsburgh, Chicago and Birmingham; on spikes and tie plates, Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; on tie plates alone, Steelton, Pa., Buffalo; on spikes alone, Youngstown, Lebanon, Pa., Richmond, Va.

SHEETS, STRIP, TIN PLATE, TERNE PLATE

Sheets

Hot Rolled

	Base per Lb.
No. 10, f.o.b. Pittsburgh	2.15c.
No. 10, f.o.b. Gary	2.25c.
No. 10, del'd Detroit	2.35c.
No. 10, del'd Philadelphia	2.46c.
No. 10, f.o.b. Birmingham	2.30c.
No. 10, f.o.b. cars dock Pacific ports	2.70c.

Hot-Rolled Annealed

No. 24, f.o.b. Pittsburgh	2.80c.
No. 24, f.o.b. Gary	2.90c.
No. 24, del'd Detroit	3.00c.
No. 24, del'd Philadelphia	3.11c.
No. 24, f.o.b. Birmingham	2.95c.
No. 24, f.o.b. cars dock Pacific ports	3.45c.
No. 24, wrought iron, Pittsburgh	4.50c.

Heavy Cold-Rolled

No. 10 gage, f.o.b. Pittsburgh	2.80c.
No. 10 gage, f.o.b. Gary	2.90c.
No. 10 gage, f.o.b. Detroit	3.00c.
No. 10 gage, del'd Philadelphia	3.11c.
No. 10 gage, f.o.b. Birmingham	2.95c.
No. 10 gage, f.o.b. cars dock Pacific ports	3.40c.

Light Cold-Rolled

No. 20 gage, f.o.b. Pittsburgh	3.25c.
No. 20 gage, f.o.b. Gary	3.35c.
No. 20 gage, del'd Detroit	3.45c.
No. 20 gage, del'd Philadelphia	3.56c.
No. 20 gage, f.o.b. Birmingham	3.40c.
No. 20 f.o.b. cars dock Pacific ports	3.80c.

Galvanized Sheets

No. 24 gage, f.o.b. Pittsburgh	3.40c.
No. 24, f.o.b. Gary	3.50c.
No. 24, del'd Philadelphia	3.71c.
No. 24, f.o.b. Birmingham	3.55c.
No. 24, f.o.b. cars dock Pacific ports	4.00c.
No. 24, wrought iron, Pittsburgh	5.15c.

Electrical Sheets
(F.o.b. Pittsburgh)

	Base per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
Special Motor	5.10c.
Special Dynamo	5.80c.
Transformer	6.30c.
Transformer Special	7.30c.
Transformer Extra Special	7.80c.

Silicon Strip in coils—Sheet price plus silicon sheet extra width extras plus 25c. per 100 lb. for coils.

Long Ternes

No. 24, unassorted 8-lb. coating f.o.b. Pittsburgh	3.70c.
F.o.b. Gary	3.80c.
F.o.b. cars dock Pacific ports	4.40c.

Vitreous Enameling Stock

No. 20, f.o.b. Pittsburgh	3.20c.
No. 20, f.o.b. Gary	3.30c.
No. 20, f.o.b. Birmingham	3.80c.
No. 20, f.o.b. cars dock Pacific ports	3.80c.

Tin Mill Black Plate

No. 28, f.o.b. Pittsburgh	2.95c.
No. 28, Gary	3.05c.
No. 28, cars dock Pacific ports	3.55c.

Tin Plate

	Base per Box
Standard cokes, f.o.b. Pittsburgh district mill	$5.25
Standard cokes, f.o.b. Gary	5.35

Terne Plate
(F.o.b. Pittsburgh)
(Per Package, 20 x 28 in.)

8-lb. coating I.C.	$10.00
15-lb. coating I.C.	12.00
20-lb. coating I.C.	13.00
25-lb. coating I.C.	14.00
30-lb. coating I.C.	15.25
40-lb. coating I.C.	17.50

Hot-Rolled Hoops, Bands, Strips and Flats under ¼ In.

	Base per Lb.
All widths up to 24 in., Pittsburgh	2.15c.
All widths up to 24 in., Chicago	2.25c.
All widths up to 24 in., del'd Detroit	2.35c.
All widths up to 24 in., Birmingham	2.30c.
Cooperage stock, Pittsburgh	2.25c.
Cooperage stock, Chicago	2.35c.

Cold-Rolled Strip*

	Base per Lb.
F.o.b. Pittsburgh	2.85c.
F.o.b. Cleveland	2.85c.
Del'd Chicago	3.145c.
F.o.b. Worcester	3.05c.

* Carbon 0.25 and less.

Cold-Rolled Spring Steel

		Pittsburgh and Cleveland	Worcester
Carbon	0.25-0.50%	2.85c.	3.05c.
Carbon	.51- .75	3.70c.	3.90c.
Carbon	.76-1.00	5.45c.	5.65c.
Carbon	Over 1.00	7.50c.	7.70c.

Fender Stock

No. 14, Pittsb'gh or Cleveland	3.10c.
No. 14, Worcester	3.50c.
No. 20, Pittsb'gh or Cleveland	3.50c.
No. 20, Worcester	3.90c.

WIRE PRODUCTS

(Carload lots, f.o.b. Pittsburgh and Cleveland.)

To Manufacturing Trade

	Per Lb.
Bright wire	2.60c.
Spring wire	3.20c.

Chicago prices on products sold to the manufacturing trade are $1 a ton above Pittsburgh or Cleveland. Worcester and Duluth prices are $2 a ton above, Birmingham $3 above, and Pacific Coast prices $9 a ton above Pittsburgh or Cleveland.

To the Trade

	Base per Keg
Standard wire nails	$2.25
Smooth coated nails	2.25

	Base per 100 Lb.
Annealed fence wire	$2.80 to $2.90
Galvanized fence wire	3.15 to 3.30
Polished staples	2.95
Galvanized staples	3.20
Barbed wire, galvanized	2.75
Twisted barbless wire	2.75
Woven wire fence, base column	63.00
Single loop bale ties, base column	55.00

Chicago and Anderson, Ind., mill prices are $1 a ton over Pittsburgh base (on all products except woven wire fence, for which the Chicago price is $2 above Pittsburgh); Duluth, Minn., mill prices are $2 a ton over Pittsburgh except for woven wire fence, which is $3 over Pittsburgh and Birmingham mill prices are $3 a ton over Pittsburgh.

On wire nails, barbed wire and staples, prices at Houston, Galveston and Corpus Christi, Tex., New Orleans, Lake Charles, La., and Mobile, Ala., are $6 a ton over Pittsburgh.

On nails, staples and barbed wire, prices of $6 a ton above Pittsburgh are also quoted at Beaumont and Orange, Tex.

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

F.o.b. Pittsburgh only on wrought iron pipe.

Butt Weld

Steel In.	Black	Galv.	*Wrought Iron* In.	Black	Galv.
⅛	.57	37	⅛	+91½	+138
¼ to ⅜	.60	44½	¼ & ⅜	+1½	+21½
½	.64½	55	½	.31½	15
¾	.67½	59	¾	.36½	20½
1 to 3	.69½	61½	1 & 1¼	.39½	25½
			1½	.43½	28
			2	.41½	26

Lap Weld

2	.62	53½	2	.37	22½
2½ to 3.65		56½	2½ to 3½	38	25
3½ to 6.67		58½	4 to 8	.40	28½
7 & 8.66		56½	9 to 12	.38	24½
9 & 10.65½		56			
11 & 12.64½		55			

Butt Weld, extra strong, plain ends

⅛	.55½	42½	⅛	+13	+45½
¼ to ⅜	.57½	46½	¼ & ⅜	+2½	+34½
½	.62½	54½	½	.32½	17½
¾	.66½	58½	¾	.37½	22½
1 to 3	.68	61	1 to 2	.43½	29

Lap Weld, extra strong, plain ends

2	.60	52½	2	.40	26
2½ to 3.64		56½	2½ to 4.45½		33
3½ to 6.67½		60	4½ to 6.45		33½
7 & 8	.66½	57	7 & 8.46		33
9 & 10	.65½	56	9 to 12.41½		30
11 & 12	.64½	55			

On butt-weld and lap-weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

Note—Chicago district mills have a base two points less than the above discounts. Chicago delivered base is 2½ points less. Freight is figured from Pittsburgh, Lorain, Ohio, and Chicago district mills, the billing being from the point producing the lowest price to destination.

Boiler Tubes

Seamless Steel Commercial Boiler Tubes and Locomotive Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh in carload lots)

		Cold Drawn	Hot Rolled
1 in. o.d.	13 B.W.G.	$ 8.60	$ 7.82
1¼ in. o.d.	13 B.W.G.	10.19	9.26
1½ in. o.d.	13 B.W.G.	11.26	10.23
1¾ in. o.d.	13 B.W.G.	12.81	11.64
2 in. o.d.	13 B.W.G.	14.35	13.04
2¼ in. o.d.	13 B.W.G.	16.00	14.54
2½ in. o.d.	12 B.W.G.	17.61	16.01
2½ in. o.d.	12 B.W.G.	19.29	17.54
2¾ in. o.d.	12 B.W.G.	20.45	18.59
3 in. o.d.	12 B.W.G.	$21.45	$19.50
4½ in. o.d.	10 B.W.G.	41.08	37.35
3½ in. o.d.	11 B.W.G.	27.09	24.62
4 in. od.	10 B.W.G.	33.60	30.54
4½ in. o.d.	10 B.W.G.	41.08	37.35
5 in. o.d.	9 B.W.G.	51.56	46.87
6 in. o.d.	7 B.W.G.	79.15	71.90

Extra for less-carload quantities:

25,000 lb. or ft. to 39,999 lb. or ft.	5 %
12,000 lb. or ft. to 24,999 lb. or ft.	12½ %
6,000 lb. or ft. to 11,999 lb. or ft.	25 %
2,000 lb. or ft. to 5,999 lb. or ft.	35 %
Under 2,000 lb. or ft.	50 %

CAST IRON WATER PIPE

	Per Net Ton
*6-in. and larger, del'd Chicago	$50.40
6-in. and larger, del'd New York	48.00
*6-in. and larger, Birmingham	42.00
6-in. and larger, f.o.b. dock, San Francisco or Los Angeles	50.00
F.o.b. dock, Seattle	42.50
4-in., f.o.b. dock, San Francisco or Los Angeles	53.00
F.o.b. dock, Seattle	53.50

Class "A" and gas pipe, $3 extra.
4-in. pipe is $3 a ton above 6-in.

* Prices for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $41, Birmingham, and $49.50, delivered Chicago; and 4-in. pipe, $44, Birmingham, and $52.40 a ton, delivered Chicago.

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

	Per Cent Off List
Machine and carriage bolts:	
½ in. x 6 in. and smaller	70
Larger than ½ in.	65 and 10
Lag bolts	65 and 10
Plow bolts, Nos. 1, 2, 3, and 7 heads	65, 10 and 10
Hot-pressed nuts, blank or tapped, square	65 and 10
Hot-pressed nuts, blank or tapped, hexagon	65 and 10
C.p.c. and t. square or hex. nuts, blank or tapped	65 and 10
Semi-finished hexagon nuts, U.S.S. and S.A.E., all sizes	60, 20 and 5
Stove bolts in packages, nuts attached	72½
Stove bolts in packages, with nuts separate	72½ and 5
Stove bolts in bulk	81½

On stove bolts freight is allowed to destination on 200 lb. and over.

Large Rivets

(½-in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh or Cleveland	$3.25
F.o.b. Chicago or Birmingham	3.35

Small Rivets

(7/16-in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh	70 and 5
F.o.b. Cleveland	70 and 5
F.o.b. Chicago and Birm'g'm.	70 and 5

Cap and Set Screws

(Freight allowed up to but not exceeding 65c. per 100 lbs. on lots of 200 lb. or more)

	Per Cent Off List
Milled cap screws, 1 in. dia. and smaller	50 and 10
Milled standard set screws, case hardened, 1 in. dia. and smaller	75
Milled headless set screws, cut thread ¾ in. and smaller	75
Upset hex. head cap screws U.S.S. or S.A.E. thread, 1 in. and smaller	60
Upset set screws, cup and oval points	75
Milled studs	65

Alloy and Stainless Steel

Alloy Steel Blooms, Billets and Slabs

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem.
Base price, $51 a gross ton.

Alloy Steel Bars

F.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.
Open-hearth grade, base 2.55c. to 2.75c.
Delivered, Detroit .....2.70c. to 2.90c.

S.A.E. Series Numbers	Alloy Differential per 100 lb.
2000 (½% Nickel)	$0.25
2100 (2½% Nickel)	0.95
2300 (3½% Nickel)	1.50
2500 (5% Nickel)	2.25
3100 Nickel Chromium	0.55
3200 Nickel Chromium	1.35
3300 Nickel Chromium	3.80
3400 Nickel Chromium	3.20
4100 Chromium Molybdenum (0.15 to 0.25 Molybdenum)	0.50
4100 Chromium Molybdenum (0.25 to 0.40 Molybdenum)	0.70
4600 Nickel Molybdenum (0.20 to 0.30) Molybdenum (1.50 to 2.00 Nickel)	1.05
5100 Chromium Steel (0.60 to 0.90 Chromium)	0.35
5100 Chromium Steel (0.80 to 1.10 Chromium)	0.45
5100 Chromium Spring Steel	base
6100 Chromium Vanadium Bar	1.10c.
6100 Chromium Vanadium Spring Steel	0.70
Chromium Nickel Vanadium	1.40
Carbon Vanadium	0.85

These prices are for hot-rolled steel bars. The differential for most grades in electric turned steel is 50c. higher. The differential for cold-drawn bars ½c. per lb. higher with separate extras. Blooms, billets and slabs under 4x4 in. or equivalent are sold on the bar base. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base. Sections 4x4 in. to 10x10 in. or equivalent carry a gross ton price, which is the net price for bars for the same analysis. Larger sizes carry extras.

Alloy Cold-Finished Bars

F.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo, 3.05c. to 3.25c. base per lb. Delivered Detroit, 3.20c. to 3.40c.

STAINLESS STEEL No. 302

(17 to 19% Cr, 7 to 9% Ni, 0.08 to 0.20% C.)

(Base Prices f.o.b. Pittsburgh)

	Per Lb.
Forging billets	19.55c.
Bars	23c.
Plates	26c.
Structural shapes	23c.
Sheets	33c.
Hot-rolled strip	20¾c.
Cold-rolled strip	27c.
Drawn wire	23c.

TOOL STEEL

	Base per Lb.
High speed	57½c.
High carbon chrome	37c.
Oil hardening	21c.
Special	19c.
Extra	15¾c.
Regular	12½c.

Prices for warehouse distribution to all points on or East of Mississippi River are 2c. a lb. higher. West of Mississippi quotations are 3c. a lb. higher.

British and Continental

BRITISH

Per Gross Ton
f.o.b. United Kingdom Ports

Based on Exchange rate as of Dec. 9

Ferromanganese, export	$44.10
Billets, open-hearth	28.78 to $31.01
Tin plate, per base box	4.59
Steel bars, open-hearth	38.59
Beams, open-hearth	37.36
Channels, open-hearth	38.59
Angles, open-hearth	37.36
Black sheets, No. 24 gage	53.87
Galvanized sheets, No. 24 gage	64.92

CONTINENTAL

Per Metric Ton, f.o.b. Continental Ports

Based on Exchange rate of Dec. 9

Billets, Thomas	$15.51
Wire rods, No. 5 B.W.G.	25.70
Steel bars, merchant	20.65
Sheet bars	15.79
Plate, ¼ in. and up	30.94
Plate, 3/16 in. and 5 mm.	26.36
Sheets, ⅛ in.	25.67
Beams, Thomas	17.82
Angles (Basic)	17.82
Hoops and strip, base	22.84
Wire, plain, No. 8	30.66
Wire nails	32.83
Wire, barbed, 4 pt. No. 10 B.W.G.	49.97

IRON AND STEEL WAREHOUSE PRICES

PITTSBURGH

	Base per Lb.
Plates	3.25c.
Structural shapes	3.25c.
Soft steel bars and small shapes	3.15c.
Reinforcing steel bars	3.15c.
Cold-finished and screw stock:	
Rounds and hexagons	3.60c.
Squares and flats	3.60c.
Hot rolled strip incl. 3/16 in. thick, under 24 in. wide	3.30c.
Hoops	3.80c.
Hot-rolled annealed sheets (No. 24), 25 or more bundles	3.45c.
Galv. sheets (No. 24), 25 or more bundles	4.05c.
Hot-rolled sheets (No. 10)	3.05c.
Galv. corrug. sheets (No. 28), per square (more than 3750 lb.)	$3.77
Spikes, large	3.25c.
	Per Cent Off List
Track bolts, all sizes, per 100 count	60
Machine bolts, 100 count	65-5
Carriage bolts, 100 count	65-5
Nuts, all styles, 100 count	65-5
Large rivets, base per 100 lb.	$3.65
Wire, black, soft ann'l'd, base per 100 lb.	3.15c.
Wire, galv. soft, base per 100 lb.	3.55c.
Common wire nails, per keg	2.50c.
Cement coated nails, per keg.	2.50c.

On plates, structurals, bars, reinforcing bars, bands, hoops and blue annealed sheets, base applies to orders of 400 to 9999 lb.

*Delivered in Pittsburgh switching district.

CHICAGO

	Base per Lb.
Plates and structural shapes.	3.30c.
Soft steel bars, rounds	3.20c.
Soft steel bars, squares and hexagons	3.35c.
Cold-fin. steel bars:	
Rounds and hexagons	3.75c.
Flats and squares	3.75c.
Hot-rolled strip	3.40c.
Hot-rolled annealed sheets (No. 24)	4.05c.
Galv. sheets (No. 24)	4.65c.
Spikes (keg lots)	3.85c.
Track bolts (keg lots)	4.85c.
Rivets, structural (keg lots)	3.80c.
Rivets, boiler (keg lots)	3.90c.
	Per Cent Off List
Machine bolts	*65
Carriage bolts	*65
Lag screws	*65
Hot-pressed nuts, sq. tap or blank	*65
Hot-pressed nuts, hex. tap or blank	*65
Hex. head cap screws	60
Cut point set screws	75 and 10
Flat head bright wood screws	62 and 20
Spring cotters	55
Stove bolts in full packages	70
Rd. hd. tank rivets, 7/16 in. and smaller	57½
Wrought washers	$4.50 off list
Black ann'l'd wire per 100 lb.	$3.95
Com. wire nails, 50 kegs or more	2.50c.†
Cement c't'd nails, 50 kegs or more	2.50c.†

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. All prices are f.o.b. consumers' plants wihtin the Chicago switching district.

*These are quotations delivered to city trade for quantities of 100 lb. or more. For lots of less than 100 lb., the quotation is 65 per cent off. Discounts applying to country trade are 70 per cent off, f.o.b. Chicago, with full or partial freight allowed up to 50c. per 100 lb.

†Prices for city and suburbs only.

NEW YORK

	Base per Lb.
Plates, ¼ in. and heavier	3.50c.
Structural shapes	3.47c.
Soft steel bars, rounds	3.51c.
Iron bars, Swed. charcoal	6.75c. to 7.00c.
Cold-fin. shafting and screw stock:	
Rounds and hexagons	4.06c.
Flats and squares	4.06c.
Cold-rolled; strip, soft and quarter hard	3.36c.
Hoops	3.66c.
Bands	3.66c.
Hot-rolled sheets (No. 10)	3.15c. to 3.41c.
Hot-rolled ann'l'd sheets (No. 24*)	3.75c. to 4.10c.
Galvanized sheets (No. 24*)	4.10c. to 4.50c.
Long terne sheets (No. 24)	5.25c. to 5.35c.
Armco iron, galv. (No. 24†)	5.65c.
Toncan iron, galv. (No. 24†)	5.65c.
Galvannealed (No. 24†)	5.75c.
Armco iron, hot-rolled annealed (No. 24†)	5.10c.
Toncan iron, hot-rolled annealed (No. 24†)	5.10c.
Armco iron hot-rolled (No. 10†)	4.15c.
Toncan iron, hot-rolled (No. 10†)	4.15c.
Cold-rolled sheets (No. 20) less than 1000 lbs.	
Standard quality	4.65c.
Deep drawing	5.40c.
Stretcher leveled	5.40c.
SAE, 2300, hot-rolled	6.97c.
SAE, 3100, hot-rolled	5.37c.
SAE, 6100, hot-rolled, annealed	9.57c.
SAE, 2300, cold-rolled	8.03c.
SAE, 3100, cold-rolled, annealed	7.43c.
Floor plate ⅛ in. and heavier	5.30c.
Standard tool steel	11.25c.
Wire, black annealed (No. 9).	3.50c.
Wire, galv. (No. 9)	3.85c.
Tire steel, 1 x ½ in. and larger	3.85c.
Open-hearth spring steel	4.00c. to 10.00c.
Common wire nails, base per keg	$3.21
	Per Cent Off List
Machine bolts, square head and nut:	
All diameters	65 and 10
Carriage bolts, cut thread:	
All diameters	65 and 10

* No. 28 and lighter, 36 in. wide, 20c. higher per 100 lb.

† 125 lb. and more.

ST. LOUIS

	Base per Lb.
Plates and struc. shapes	3.55c.
Bars, soft steel (rounds and flats)	3.45c.
Bars, soft steel (squares, hexagons, ovals, half ovals and half rounds)	3.60c.
Cold-fin. rounds, shafting, screw stock	4.00c.
Hot-rolled annealed sheets (No. 24)	4.30c.
Galv. sheets (No. 24)	4.90c.
Hot-rolled sheets (No. 10)	3.40c.
Black corrug. sheets (No. 24)	4.30c.
*Galv. corrug. sheets	4.90c.
Structural rivets	4.15c.
Boiler rivets	4.25c.
	Per Cent Off List
Tank rivets, 7/16 in. and smaller.	55
Machine and carriage bolts, lag screws, fitting up bolts, bolt ends, plow bolts, hot-pressed nuts, square and hexagon, tapped or blank, semi-finished nuts; all quantities	65

*No. 26 and lighter take special prices.

PHILADELPHIA

	Base per Lb.
*Plates, ¼-in. and heavier	3.10c.
*Structural shapes	3.10c.
*Soft steel bars, small shapes, iron bars (except bands)	3.25c.
‡Reinforc. steel bars, sq. twisted and deformed	3.01c.
Cold-finished steel bars	4.01c.
*Steel hoops	3.55c.
*Steel bands, No. 12 and 3/16 in. incl.	3.30c.
Spring steel	5.00c.
†Hot-rolled anneal. sheets (No. 24)	4.15c.
†Galvanized sheets (No. 24)	4.80c.
*Hot-rolled annealed sheets (No. 10)	3.20c.
Diam. pat. floor plates, ¼ in.	5.05c.
Swedish iron bars	6.25c.

These prices are subject to quantity differential except on reinforcing and Swedish iron bars.

*Base prices subject to deduction on orders aggregating 4000 lb. or over.

†For 25 bundles or over.

‡For less than 2000 lb.

CLEVELAND

	Base per Lb.
Plates and struc. shapes	3.41c.
Soft steel bars	3.10c.
‡Reinforc. steel bars	2.10c.
†Cold-finished steel bars	3.75c.
Flat-rolled steel under ¼ in.	3.46c.
Cold-finished strip	†3.00c.
Hot-rolled annealed sheets (No. 24)	3.91c.
Galvanized sheets (No. 24)	4.61c.
Hot-rolled sheets (No. 10)	3.21c.
Hot-rolled 3/16 in. 24 to 48 in. wide sheets	3.46c.
*Black ann'l'd wire, per 100 lb.	$2.80
*No. 9 galv. wire, per 100 lb.	3.15
*Com. wire nails, base per keg	2.25

†Outside delivery 10c. less.

*For 5000 lb. or less.

‡Plus switching and cartage charges and quantity differentials up to 50c.

CINCINNATI

	Base per Lb.
Plates and struc. shapes	3.52c.
Floor plates	5.27c.
Bars, rounds, flats and angles.	3.42c.
Other shapes	3.57c.
Rail steel reinforc. bars	3.25c.
Hoops and bands, 3/16 in. and lighter	3.57c.
Cold-finished bars	3.97c.
Hot-rolled annealed sheets (No. 24) 25 bundles or more.	3.72c.
Galv. sheets (No. 24) 3750 lb. or more	4.07c.
Galvanized sheets (No. 24) over 3500 lb.	4.07c.
Hot-rolled sheets (No. 10)	3.32c.
Structural rivets	4.50c.
Small rivets	55 per cent off list
No. 9 ann'l'd wire, per 100 lb. (1000 lb. or over)	$2.88
Com. wire nails, base per keg:	
Any quantity less than carload.	3.04
Cement c't'd nails, base 100-lb keg	3.50
Chain. lin. per 100 lb.	8.35
	Net per 100 Ft.
Seamless steel boiler tubes, 2-in.	$20.37
4-in.	48.14
Lap-welded steel boiler tubes, 2-in.	19.38
4-in.	45.32

BUFFALO

	Base per Lb.
Plates	3.48c.
Struc. shapes	3.35c.
Soft steel bars	3.25c.
Reinforcing bars	2.60c.
Cold-fin. flats and sq.	3.80c.
Rounds and hex.	3.80c.
Cold-rolled strip steel	3.19c.
Hot-rolled annealed sheets (No. 24)	4.26c.
Heavy hot-rolled sheets (3/16 in., 24 to 48 in. wide)	3.53c.
Galv. sheet (No. 24)	4.80c.
Bands	3.53c.
Hoops	3.53c.
Heavy top-rolled sheets	3.28c.
Com. wire nails, base per keg.	$2.85
Black wire, base per 100 lb. (2500-lb. lots or under)	4.00
(Over 2500 lb.)	3.90

BOSTON

	Base per Lb.
Channels, angles	3.80c.
Tees and zees, under 3"	4.05c.
H beams and shapes	3.79c.
Plates — Sheared, tank, and univ. mill, ¼ in. thick and heavier	3.81c.
Floor plates, diamond pattern	5.61c.
Bar and bar shapes (mild steel)	3.80c.
Bands 3/16 in. thick and No. 12 ga. incl.	3.95c. to 4.95c.
Half rounds, half ovals, ovals and bevels	5.05c.
Tire steel	5.05c.
Cold-rolled strip steel	2.60c.
Cold-finished rounds, squares and hexagons	4.30c.
Cold-finished flats	4.25c.
Blue annealed sheets, No. 10 ga.	3.95c.
One pass cold-rolled sheets No. 24 ga.	4.55c.
Galvanized steel sheets, No. 24 ga.	4.55c.
Lead coated sheets, No. 24 ga.	6.20c.

Price delivered by truck in metropolitan Boston, subject to quantity differentials.

DETROIT

	Base per Lb.
Soft steel bars	3.29c.
Structural shapes	3.52c.
Plates	3.52c.
Floor plates	5.27c.
Hot-rolled annealed sheets (No. 24)*	4.14c.
Hot-rolled sheets (No. 10)**	3.24c.
Galvanized sheets (No. 24)	4.82c.
Bands	3.49c.
Hoops	3.49c.
†Cold-finished bars	3.84c.
Cold-rolled strip	3.18c.
Hot-rolled alloy steel (S.A.E. 3100 Series)	5.44c.
Bolts and nuts, in cases, 70 and 10 per cent off list	
Broken cases..65 and 10 per cent off	

Prices delivered by truck in metropolitan Detroit, subject to quantity differentials covering shipment at one time.

* Base less 0.25c., 3500 lb. and over. Add 0.50c. per hundred lb. for broken bundles.

** Base less 0.25c., 1500 to 3749 lbs.; less 0.50c., 3750 to 7499 lb.; less 0.75c., 7500 lb. and over.

Galvanized and hot-rolled annealed may not be combined to obtain quantity deductions.

Country territory to be equalized on the Chicago plan.

MILWAUKEE

	Base per Lb.
Plates and structural shapes..	3.41c.
Soft steel bars, rounds up to 8 in., flats and fillet angles	3.31c.
Soft steel bars, squares and hexagons	3.46c.
Hot-rolled strip	3.51c.
Hot-rolled sheets (No. 10)	3.26c.
Hot-rolled annealed sheets (No. 24)	4.16c.
Galvanized sheets (No. 20)	4.76c.
Cold-finished steel bars	3.76c.
Cold-rolled strip	3.33c.
Structural rivets (keg lots)	4.01c.
Boiler rivets, cone head (keg lots)	4.11c.
Track spikes (keg lots)	4.06c.
Track bolts (keg lots)	5.06c.
Black annealed wire	3.40c.
Com. wire nails	2.60c.
Cement coated nails	2.60c.

	Per Cent Off List
Machine bolts carriage bolts and lag screws	70 to 75
Hot-pressed nuts, sq. and hex. tapped or blank (keg lots)	70

Prices given above are delivered Milwaukee.

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. On galvanized and No. 24 hot-rolled annealed sheets the prices given apply on orders of 400 to 1500 lb. On cold-finished bars the prices are for orders of 1000 lb. or more of a size.

ST. PAUL

	Base per Lb.
Mild steel bars, rounds	3.45c.
Structural shapes	3.55c.
Plates	3.55c.
Cold-finished bars	4.00c.
Bands and hoops	3.65c.
Hot-rolled annealed sheets, No. 24	4.30c.
Galvanized sheets, No. 24	4.90c.

On mild steel bars, shapes, plates and hoops and bands the base applies on 400 to 14,999 lb. On hot-rolled sheets, galvanized sheets and cold-rolled sheets base applies on 15,000 lb. and over. Base on cold-finished bars is 1000 lb. and over of a size.

BALTIMORE

	Base per Lb.
Mild steel bars and small shapes	3.20c.
Structural shapes	3.10c.
Reinforcing bars	....prices on application
Plates	3.10c.
Hot-rolled sheets, No. 10	3.20c.
Bands	3.30c.
Hoops	3.55c.
Special threading steel	3.20c.
Diamond pattern floor plates ¼ in. and heavier	5.10c.
Galvanized bars and small shapes	5.70c.
Galvanized bands	5.80c.
Cold-rolled rounds, hexagons, squares and flats, 1000 lb. and more	3.88c.

All prices are for 2000 lb. and more.

For second zone add 10c. per 100 lb. for trucking.

List size extras of Aug. 15, 1935, and cutting extras to be added.

For cold-rolled products, list size extras from Jan. 1, 1936, and cutting extras to be added.

CHATTANOOGA

	Base per Lb.
Mild steel bars	3.46c.
Iron bars	3.46c.
Reinforcing bars	3.46c.
Structural shapes	3.66c.
Plates	3.66c.
Hot-rolled sheets No. 10	3.46c.
Hot-rolled annealed sheets, No. 24*	3.41c.
Galvanized sheets No. 24*	3.96c.
Steel bands	3.71c.
Cold-finished bars	4.281c.

* Plus mill item extra.

MEMPHIS

	Base per Lb.
Mild steel bars	3.57c.
Shapes, bar size	3.57c.
Iron bars	3.57c.
Structural shapes	3.77c.
Plates	3.77c.
Hot-rolled sheets, No. 10	3.57c.
Hot-rolled annealed sheets, No. 24	4.37c.
Galvanized sheets, No. 24	5.07c.
Steel bands	3.82c.
Cold-drawn rounds	4.04c.
Cold-drawn flats, squares, hexagons	6.04c.
Structural rivets	4.25c.
Bolts and nuts, per cent off list	65
Small rivets, per cent off list	50

NEW ORLEANS

	Base per Lb.
Mild steel bars	3.45c.
Reinforcing bars	3.50c.
Structural shapes	3.65c.
Plates	3.65c.
Hot-rolled sheets, No. 10	3.65c.
Hot-rolled annealed sheets, No. 24	4.35c.
Galvanized sheets, No. 24	4.95c.
Steel bands	4.05c.
Cold-finished steel bars	4.55c.
Structural rivets	4.25c.
Boiler rivets	4.25c.
Common wire nails, base per keg	$2.45
Bolts and nuts, per cent off list	70

PACIFIC COAST

	Base per Lb. San Francisco	Los Angeles	Seattle
Plates, tank and U. M.	3.60c.	3.80c.	3.65c.
Shapes, standard	3.60c.	3.80c.	3.65c.
Soft steel bars	3.60c.	3.80c.	3.90c.
Reinforcing bars, f.o.b. cars dock Pacific ports	2.45c.	2.45c.	2.45c.
Hot-rolled annealed sheets (No. 24)	4.30c.	4.35c.	4.60c.
Hot-rolled sheets (No. 10)	3.70c.	3.90c.	3.85c.
Galv. sheets (No. 24 and lighter)	5.00c.	4.60c.	5.00c.
Galv. sheets (No. 22 and heavier)	5.00c.	4.80c.	5.00c.
Cold finished steel			
Rounds	6.05c.	6.10c.	6.00c.
Squares and hexagons	7.30c.	7.35c.	6.35c.
Flats	7.80c.	7.85c.	7.35c.
Common wire nails—base per keg less carload	$2.90	$2.90	$2.90

All items subject to differentials for quantity.

REFRACTORIES PRICES

Fire Clay Brick

	Per 1000 f.o.b. Works
High-heat duty, Pennsylvania, Maryland, Kentucky, Missouri and Illinois	$45.00
High-heat duty, New Jersey	50.00
High-heat duty, Ohio	40.00
Intermediate, Pennsylvania, Maryland, Kentucky, Missouri and Illinois	40.00
Intermediate, New Jersey	43.00
Intermediate, Ohio	35.00
Ground fire clay, per ton	7.00

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$45.00
Chicago District	54.00
Birmingham	$48 to 50.00
Silica cement per net ton	8.00

Chrome Brick

	Per Net Ton
Standard f.o.b. Baltimore, Plymouth Meeting and Chester	$45.00
Chemically bonded f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	45.00

Magnesite Brick

	Per Net Ton
Standard f.o.b. Baltimore and Chester, Pa.	$65.00
Chemically bonded, f.o.b. Baltimore	55.00

Grain Magnesite

	Per Net Ton
Imported, f.o.b. Baltimore and Chester, Pa. (in sacks)	$45.00
Domestic, f.o.b. Baltimore and Chester, in sacks	40.00
Domestic, f.o.b. Chewelah, Wash.	22.00

RAW MATERIALS PRICES

PIG IRON

No. 2 Foundry

F.o.b. Everett, Mass.	$22.75
F.o.b. Bethlehem, Birdsboro, and Swedeland, Pa., and Sparrows Point, Md.	21.50
Delivered Brooklyn	23.9289
Delivered Newark or Jersey City	22.9873
Delivered Philadelphia	22.3132
F.o.b. Neville Island, Sharpsville and Erie, Pa.; Buffalo; Youngstown, Cleveland, Toledo and Hamilton, Ohio; Detroit; Chicago and Granite City, Ill.	20.50
F.o.b. Jackson, Ohio	22.25
Delivered Cincinnati	20.82
F.o.b. Duluth	21.00
F.o.b. Provo, Utah	18.50
Delivered San Francisco, Los Angeles or Seattle	23.315
F.o.b. Birmingham*	16.88

* Delivered prices on southern iron for shipment to northern points are 38c. a ton below delivered prices from nearest northern basing point on iron with phosphorus content of .70 and over.

Malleable

Base prices on malleable iron are 50c. a ton above No. 2 foundry quotations at Everett, Eastern Pennsylvania furnaces, Erie and Buffalo. Elsewhere they are the same.

Basic

F.o.b. Everett, Mass.	$22.25
F.o.b. Bethlehem, Birdsboro, Swedeland and Steelton, Pa., and Sparrows Point, Md.	21.00
F.o.b. Buffalo	19.50
F.o.b. Neville Island, Sharpsville and Erie, Pa.; Youngstown, Cleveland, Toledo and Hamilton, Ohio; Detroit; Chicago and Granite City, Ill.	20.00
Delivered Cincinnati	19.82
Delivered Canton, Ohio	21.3482
Delivered Mansfield, Ohio	21.8832
F.o.b. Jackson, Ohio	21.75
F.o.b. Provo, Utah	18.00
F.o.b. Birmingham	15.50

Bessemer

F.o.b. Everett, Mass.	$23.75
F.o.b. Bethlehem, Birdsboro and Swedeland, Pa.	22.50
Delivered Boston Switching District	24.00
Delivered Newark or Jersey City	23.9873
Delivered Philadelphia	23.3132
F.o.b. Buffalo and Erie, Pa., and Duluth	21.50
F.o.b. Neville Island and Sharpsville, Pa.; Youngstown, Cleveland, Toledo and Hamilton, Ohio; Detroit; Chicago	21.00
F.o.b. Birmingham	22.00
Delivered Cincinnati	22.0807
Delivered Canton, Ohio	22.3482
Delivered Mansfield, Ohio	22.8832

Low Phosphorus

Basing points: Birdsboro, Pa., Steelton, Pa., and Standish, N. Y.	$25.00

Gray Forge

Valley or Pittsburgh furnace	$20.00

Charcoal

Lake Superior furnace	$23.00
Delivered Chicago	26.2528

Canadian Pig Iron

Per Gross Ton

Delivered Toronto

No. 1 fdy., sil. 2.25 to 2.75	$21.00
No. 2 fdy., sil. 1.75 to 2.75	20.50
Malleable	22.50

Delivered Montreal

No. 1 fdy., sil. 2.25 to 2.75	$22.50
No. 2 fdy., sil. 1.75 to 2.25	22.00
Malleable	22.50
Basic	22.00

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

Per Gross Ton

Domestic, 80% (carload)	$80.00

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%	$26.00
50-ton lots 3-mo. shipment	24.00
F.o.b. New Orleans	26.00

Electric Ferrosilicon

Per Gross Ton Delivered

50% (carloads)	$69.50
50% (ton lots)	77.00
75% (carloads)	126.00
75% (ton lots)	136.00

Silvery Iron

Per Gross Ton

F.o.b. Jackson, Ohio, 6.00 to 6.50%	$24.00

For each additional 0.5% silicon up to 17%, 50c. a ton is added.

The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Manganese, each unit over 2%, $1 a ton additional. Phosphorus 0.75% or over, $1 a ton additional.

Bessemer Ferrosilicon

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton

10.00 to 10.50%	$29.00
10.51 to 11.00%	29.50
11.00 to 11.50%	30.00
11.51 to 12.00%	30.50
12.01 to 12.50%	31.00
12.51 to 13.00%	31.50
13.01 to 13.50%	32.00
13.51 to 14.00%	32.50
14.01 to 14.50%	33.00
14.51 to 15.00%	33.50
15.01 to 15.50%	34.00
15.51 to 16.00%	34.50
16.01 to 16.50%	35.00
16.51 to 17.00%	35.50

Manganese 2 to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional. Phosphorus 0.75% or over, $1 a ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Other Ferroalloys

Ferrotungsten, per lb. contained W del., carloads	$1.30
Ferrotungsten, lots of 5000 lb.	1.35
Ferrotungsten, smaller lots	1.40
Ferrochromium, 4 to 6% carbon and up, 65 to 70% Cr per lb. contained Cr delivered, in carloads, and contract	10.00c.
Ferrochromium, 2% carbon	16.50c. to 17.00c.
Ferrochromium, 1% carbon	17.50c. to 18.00c.
Ferrochromium, 0.10% carbon	19.50c. to 20.00c.
Ferrochromium, 0.06% carbon	20.00c. to 20.50c.
Ferrovanadium, del. per lb. contained V.	$2.70 to $2.90
Ferrocolumbium, per lb. contained columbium, f.o.b. Niagara Falls, N. Y.	$2.50
Ferrocarbontitanium, 15 to 18% Ti, 7 to 8% C, f.o.b. furnace carload and contract per net ton	$137.50
Ferrocarbontitanium, 17 to 20% Ti, 3 to 5% C, f.o.b. furnace, carload and contract, per net ton	142.50
Ferrophosphorus, electric, or blast furnace material, in carloads, f.o.b. Anniston, Ala., for 18%, with $3 unitage, freight equalized with Rockdale, Tenn., per gross ton	58.50
Ferrophosphorus, electric, 24%, in carlots, f.o.b. Anniston, Ala., per gross ton with $3 unitage, freight equalized with Nashville, Tenn.	75.00
Ferromolybdenum, per lb. Mo del.	95c.
Calcium molybdate, per lb. Mo del.	80c.
Silico spiegel, per ton, f.o.b. furnace, carloads	$38.00
Ton lots or less, per ton	43.00
Silico-manganese, gross ton, delivered.	
2.50% carbon grade	85.00
2% carbon grade	90.00
1% carbon grade	100.00

Note: Spot prices are $5 a ton higher except on 75 per cent ferrosilicon on which premium is $10 a ton.

ORES

Lake Superior Ores

Delivered Lower Lake Ports

Per Gross Ton

Old range, Bessemer, 51.50%	$4.80
Old range, non-Bessemer, 51.50%	4.65
Mesabi, Bessemer, 51.50%	4.65
Mesabi, non-Bessemer, 51.50%	4.50
High phosphorus, 51.50%	4.40

Foreign Ore

C.i.f. Philadelphia or Baltimore

Per Unit

Iron, low phos., copper free, 55 to 58% dry, Algeria	13.00c. to 13.50c.
Iron, low phos., Swedish, average, 68½% iron	Nominal
Iron, basic or foundry, Swedish, aver. 65% iron	10.00c.
Iron, basic or foundry, Russian, aver. 65% iron	Nominal
Man., Caucasian, washed 52%	27c. to 30c.
Man., African, Indian, 44-48%	25c to 30c.
Man., African, Indian, 49-51%	27c. to 30c.
Man., Brazilian, 46 to 48½%	Nominal..25c. to 30c.

Per Net Ton Unit

Tungsten, Chinese, wolframite, duty paid delivered nominal	$15.25 to $15.50
Tungsten, domestic, scheelite delivered, nominal	15.00

Per Gross Ton

Chrome, 45% Cr_2O_3, lump, c.i.f. Atlantic Seaboard (African)	$17.50
45 to 46% Cr_2O_3 (Turkish)	$16.50 to 17.00
48% Cr_2O_3 (African)	20.50
48% min. Cr_2O_3 (Turkish)	19.25
Chrome concentrate, 50% and over Cr_2O_3, c.i.f. Atlantic ports	22.00
52% Cr_2O_3 (Turkish)	21.75
48 to 49% Cr_2O_3 (Turkish)	19.25

FLUORSPAR *Per Net Ton*

Domestic, washed gravel, 85-5, f.o.b. Kentucky and Illinois mines, all rail	$18.00 to $19.00
Domestic, barge and rail	18.50 to 19.50
No. 2 lump, 85-5, f.o.b. Kentucky and Illinois mines	20.00
Foreign, 85% calcium fluoride, not over 5% silicon, c.i.f. Atlantic ports, duty paid	23.00
Domestic No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	35.00

FUEL OIL *Per Gal.*

F.o.b. Bayonne or Baltimore No. 3 distillate	4.25c.
F.o.b. Bayonne or Baltimore, No. 4 industrial	3.75c.
Del'd Ch'go, No. 3 industrial	5.00c.
Del'd Ch'go, No. 5 industrial	3.77c.
Del'd Cleve'd, No. 3 distillate	6.00c.
Del'd Cleve'd No. 4 industrial	5.75c.
Del'd Cleve'd No. 5 industrial	5.00c.

COKE AND COAL

Coke	*Per Net Ton*
Furnace, f.o.b. Connellsville, Prompt	$4.00 to $4.25
Foundry, f.o.b. Connellsville, Prompt	4.50 to 5.75
Foundry, by-product, Chicago ovens	9.00
Foundry, by-product, del'd New England	12.00
Foundry, by-product, del'd Newark or Jersey City	9.60 to 10.05
Foundry, by-product, Philadelphia	9.85
Foundry, by-product, delivered Cleveland	10.30
Foundry, by-product, delivered Cincinnati	9.50
Foundry, Birmingham	6.50
Foundry, by-product, St. Louis, f.o.b. ovens	8.00
Foundry, from Birmingham, f.o.b. cars docks, Pacific ports	14.75

Coal	*Per Net Ton*
Mine run steam coal, f.o.b. W. Pa. mines	$1.50 to $1.75
Mine run coking coal, f.o.b. W. Pa.	1.75 to 1.90
Gas coal, ¾-in. f.o.b. Pa. mines	2.00 to 2.25
Mine run gas coal, f.o.b. Pa. mines	1.80 to 2.00
Steam slack, f.o.b. W. Pa. mines	1.00 to 1.25
Gas slack, f.o.b. W. Pa. mines	1.20 to 1.45

FOR *High Quality Steels*

NIAGARA
BRAND
FERRO-ALLOYS

PITTSBURGH METALLURGICAL CO., Inc.

NIAGARA FALLS, N. Y.

SALES OFFICES: NEW YORK—30 Church St. • PITTSBURGH—Oliver Bldg. • CLEVELAND—Hanna Bldg.

PLANT EXPANSION AND EQUIPMENT BUYING

. . . Universal Atlas Cement Co., Chicago, has approved plans for expansion and modernization in mill at Hudson, N. Y., to cost $1,000,000 with equipment.

o o o

. . . Barnsdall Refining Co., Barnsdall, Okla., plans a new oil refinery near Corpus Christi, Tex., to cost with equipment close to $1,000,000.

NORTH ATLANTIC

Edwards & Co., Inc., Exterior Avenue and 140th Street, New York, manufacturer of electric signaling devices and equipment, has let general contract to W. J. Lyons, 47 Wall Street, Norwalk, Conn., for new one and two-story plant on Post Road, Norwalk, 200 x 300 ft., and 40 x 90 ft., respectively. Cost over $150,000 with equipment. Leo F. Caproni, 1221 Chapel Street, New Haven, Conn., is architect and engineer.

Duro Test Corp., 583 Broadway, New York, manufacturer of electric light bulbs, lamps, etc., has let general contract to Bonanno Construction Co., North Bergen, N. J., for new four-story plant and one-story smaller structure at Shippen Street and Hudson Boulevard, North Bergen. Equipment will be installed to give employment to about 300 persons. Cost over $100,000 with machinery. Lockwood Greene Engineers, Inc., 30 Rockefeller Plaza, New York, is engineer.

Signal Corps Procurement District, Army Base, Fifty-eighth Street and First Avenue, Brooklyn, asks bids until Dec. 28 for plugs (Circular 90), 4200 hand-focusing flashlights (Circular 94), cable and seven reels (Circular 87).

Board of Education, New York, has filed plans for first unit of new Williamsburg vocational school, Brooklyn, to be three stories, 213 x 393 ft., to include machine shops, general and automotive repair shops. Cost about $750,000. William C. Martin, Flatbush Avenue Extension and Concord Street, Brooklyn, is architect.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Jan. 5 for turbine-driven pumping units and spare parts (Schedule 9538), two motor-driven turret fox lathes (Schedule 9520), one motor-driven forging machine, bolt and rivet heading (Schedule 9519) for Brooklyn Navy Yard; switch boxes (Schedule 9509) for Brooklyn and Philadelphia yards.

Universal Atlas Cement Co., 208 South La Salle Street, Chicago, has approved plans for expansion and modernization of mill at Hudson, N. Y., including new buildings and installation of equipment. Work will be carried out by company forces. Entire project will cost close to $1,000,000 with machinery. R. A. Dittmar is superintendent at local mill.

D. Benedetto, Inc., 420 Lexington Avenue, New York, paper stock converter, a subsidiary of Robert Gair Co., 155 East Forty-fourth Street, manufacturer of corrugated containers, etc., has leased buildings at 6-12 East 134th Street, about 65,000 sq. ft. floor space, for new paper-converting plant.

Quartermaster, United States Military Academy, West Point, N. Y., asks bids until Dec. 30 for water-tapping machine, pipe fittings, parts for gas-tapping machine, gate valves, faucets and other equipment (Proposal 1052-135).

Radio Corp. of America, Inc., Camden, N. J., has plans for one-story steam power plant and factory improvements. Cost over $60,000 with equipment. Executive offices are at 30 Rockefeller Plaza, New York.

R. M. Hollingshead Corp., Ninth Street, Camden, N. J., manufacturer of refined oils, greases, soap, etc., has acquired former local plant of Keystone Leather Co., comprising 5½ acres, with group of buildings containing about 410,000 sq. ft. floor space, and will remodel for new plant. Facilities will be provided for about 500 operatives.

Commanding Officer, Ordnance Department, Picatinny Arsenal, Dover, N. J., asks bids until Dec. 28 for one hand-power toggle lever press (Circular 363).

Philadelphia Storage Battery Co., Ontario and C Streets, Philadelphia, has leased about 215,000 sq. ft. in buildings near plant for expansion.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Jan. 5 for one precision lathe (Schedule 9524), engine lathe, both motor-driven (Schedule 9529), for Philadelphia Navy Yard.

Willson Products, Inc., Thorn and Washington Streets, Reading, Pa., manufacturer of respirators, goggles and kindred safety appliances and equipment, has let general contract to E. A. Reider, Reading, for five-story addition, 92 x 125 ft. Cost close to $100,000 with equipment.

Commanding Officer, Ordnance Department, Frankford Arsenal, Philadelphia, asks bids until Dec. 28 for one head-trimming machine for cartridge cases (Circular 273); until Dec. 29, one plain light milling machine and one universal light milling machine (Circular 299).

Board of Education, Park Avenue and Fifty-ninth Street, New York, plans multi-story addition to manual training school in Brooklyn, with estimated cost of $1,165,000 including equipment; also new East New York Vocational School, Brooklyn, to replace present school, cost about $1,600,000; and new vocational school in Jamaica, Queens, similarly to replace existing unit, cost $1,680,000. Projects will be carried out in connection with 1937 high school building program to represent total investment of $12,605,000. William C. Martin, Flatbush Avenue Extension and Concord Street, Brooklyn, is architect.

BUFFALO DISTRICT

Union Carbide Co., Niagara Falls, N. Y., manufacturer of industrial chemicals, etc., has let general contract to Scrufari Construction Co., 825 Fifteenth Street, for one-story addition. Cost over $50,000 with equipment.

Elmira Light, Heat & Power Corp., Elmira, N. Y., plans extensions and improvements in steam-operated electric generating plant, including new 15,000-kw. turbo-generator unit and auxiliary equipment. Cost close to $1,000,000. Company will also make extensions in transmission and distributing lines.

Board of Education, Buffalo, James Storer, secretary, asks bids until Jan. 12 for equipment for Kensington high school, including metal chairs and stools, steel shelving, steel library stacks, metal laboratory furniture and other equipment.

Central School District No. 1, Port Byron, N. Y., plans manual training equipment in new two-story and basement high and grade school, for which bids will be asked on general contract early in spring. Cost about $500,000. Financing has been arranged through Federal aid. C. C. Ade, 52 James Street, Rochester, N. Y., is architect.

NEW ENGLAND

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Jan. 5 for one motor-driven self-contained squaring shear (Schedule 9513), one mechanical revolution counter (Schedule 9581) for Boston Navy Yard.

Arrow-Hart & Hegeman Electric Co., 103 Hawthorne Street, Hartford, has let general contract to Bartlett-Brainard Co., 16 Van Dyke Avenue, for five-story addition, 107 x 114 ft. Cost over $100,000 with equipment. Mylchreest & Reynolds, 238 Palm Street, are consulting engineers.

New Haven Clock Co., New Haven, Conn., has acquired for expansion, through its president, Richard H. Whitehead, former works of Guilford Wheel Co., Guilford, Conn., comprising tract of about seven acres, improved with four large buildings.

Armstrong Rubber Co., West Haven, Conn., manufacturer of automobile tires and other rubber products, has asked bids on general contract for three-story and basement addition, 80 x 180 ft. Cost close to $100,000 with equipment. Fletcher-Thompson, Inc., 1336 Fairfield Avenue, Bridgeport, Conn., is architect and engineer.

Hartford Electric Light Co., Hartford, plans expansion in steam-operated electric generating plant near Brainard Field, comprising new operating unit, with turbo-generator and auxiliary equipment. Extensions will be made in transmission lines. Cost about $3,500,000.

Commanding Officer, Ordnance Department, Springfield Armory, Springfield, Mass., asks bids until Dec. 28 for 1000 drill containers, 1000 tool rolls, 1000 sharpening stone containers and 1000 file containers (Circular 108).

WASHINGTON DIST.

Commanding Officer, Aberdeen Proving Grounds, Aberdeen, Md., asks bids until Jan. 11 for one motor-generator set, electric motor, manual starter, switchboard, speed limit device, master controller, control switch with fuse, three 37½ kva. transformers, five contactors and other equipment (Circular 47).

George H. Townsend, Greenwich, Conn., formerly head of American Power Boat Association, has acquired shipyard of

M. M. Davis & Son, Solomons, Md. Extensions and improvements will be made, including facilities for power boat production. William E. John, marine engineer, will be in charge of operations.

Davison Chemical Corp., 20 Hopkins Place, Baltimore, has let general contract to Austin Co., Philadelphia, for one-story addition to plant in Curtis Bay district. Cost about $30,000 with equipment.

General Purchasing Officer, Panama Canal, Washington, asks bids until Dec. 28 for bolt dies, carbon steel twist drills, stone drills, augur bits, cap screws, brass washers, automobile jacks, copper wire, breast drills, wood chisels, oil cans, paint spraying outfit and other equipment (Schedule 3207); until Dec. 29, hand spades, drop forged wrenches, monkey wrenches, carpenter's nail hammers, cutting punches, hand and bridge reamers, cast iron pipe sleeves, pipe vises, ratchet braces, screw clamps and other equipment (Schedule 3208).

Quartermaster, Marine Corps, Washington, asks bids until Dec. 28 for valves, nipples, flanges, bushings, screw washers, couplings and other equipment (Schedule 384); until Dec. 29, copper wire, wire holders, distribution transformer, wire cutters, knife switch and other supplies (Schedule 400).

Director of Public Works, 1111 East Broad Street, Richmond, Va., asks bids on general contract until Jan. 4 for two-story municipal equipment storage and distributing building, 75 x 130 ft. G. M. Bowers is director.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Jan. 5 for 7800 ft. of seamless steel tubing (Schedule 9543) for Baldwin Naval Station; oil circuit breakers and accessories (Schedule 9515) for Norfolk, Va., yard; 25 steam-jacketed galley and kitchen kettles, aluminum or corrosion-resisting steel, each 20 to 80-gal. capacity, for Sewall's Point yard, and 31 similar kettles for Mare Island yard (Schedule 9501); about 10,000 ft. wire rope (Schedule 9497) for Eastern and Western yards.

SOUTH ATLANTIC

Container Corp. of America, Inc., 111 West Washington Street, Chicago, manufacturer of corrugated board boxes and containers, has approved plans for initial units of new pulp and paperboard mill at Fernandina, Fla., where property has been secured, fronting on Amelia River. Plant is scheduled for operation late in 1937. George F. Hardy, 305 Broadway, New York, is consulting engineer.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Jan. 5 for one motor-driven shearing machine for Charleston, S. C., Navy Yard (Schedule 9566).

Walker Electrical Co., 546 Means Street, N.W., Atlanta, Ga., manufacturer of electrical equipment, has plans for new one-story plant on Northside Drive, near Hemphill Avenue. Cost about $40,000 with equipment. Robert & Co., Bona Allen Building, are architects and engineers.

SOUTHWEST

Barnsdall Refining Corp., Barnsdall, Okla., plans new oil refinery near Corpus Christi, Tex., securing oil supply from Flour Bluff oil field, about nine miles distant. It will include steel tank storage and distributing facilities, power house, pumping station and other mechanical departments. Cost close to $1,000,000 with equipment. General offices are at 4533 West Roosevelt Avenue, Chicago.

United States Engineering Office, Postal Telegraph Building, Kansas City, Mo., asks bids until Jan. 5 for furnishing, assembling, erecting and installing operating equipment for spillway gates at Fort Peck, Mont. (Circular 5). Cost about $900,000.

Contracting Officer, Quartermaster Division, Fort Riley, Kan., asks bids until Dec. 28 for one engine unit, assembled with electrical equipment, etc. (Circular 735-38).

Shamrock Oil & Gas Corp., Amarillo, Tex., will begin work in January on new oil refinery near Dumas, Tex., with steel tank storage and distributing facilities. Cost close to $500,000 with equipment.

Central Texas Power Co., Temple, Tex., plans extensions in transmission lines in parts of Travis and Williamson Counties, about 225 miles, for rural electrification, including service facilities. Fund of $240,000 has been arranged through Federal aid.

Reed Roller Bit Co., Mack Street, Houston, Tex., manufacturer of oil well equipment and supplies, has let general contract to Samuel D. Cook, 3769 Farbar Street, for one-story addition. Cost close to $30,000 with equipment.

Houston Oxygen Co., M. & M. Building, Houston, Tex., has acquired two-acre tract near Hempstead Road for new plant. Plans are being completed for initial one-story unit. Cost about $45,000 with equipment. Other structures will be erected later.

SOUTH CENTRAL

Lloyd A. Fry Roofing Co., 5302 West Sixty-sixth Street, Chicago, has acquired tract in industrial district at North Memphis, Tenn., for new branch plant, one-story, 120 x 500 ft. Cost close to $160,000 with equipment.

Firestone Tire & Rubber Co., Akron, Ohio, has let general contract to S. & W. Construction Co., Shrine Building, Memphis, Tenn., for modernizing and expanding former local factory of Murray Wood Products Co., recently acquired for new branch mill. Cost close to $400,000, instead of smaller amount, previously noted.

Louisville Gas & Electric Co., 311 West Chestnut Street, Louisville, has secured approval for expansion and improvements in steam-operated electric generating plant, including new 25,000-kw. turbo-generator unit and auxiliary equipment. Extensions will be made in transmission lines. Entire project will cost about $1,800,000.

City Council, Lancaster, Ky., will take bids soon for electric-operated pumping plant for new municipal sewage disposal works. Entire project will cost about $79,000. J. S. Watkins, Citizens' Trust Building, Lexington, Ky., is consulting engineer.

Bardstown Distillery, Inc., Bardstown, Ky., plans extensions and improvements, including additional equipment. Company is disposing of stock issue to total about $350 000, considerable part of fund to be used for purpose noted.

WESTERN PA. DIST.

Perry Furnace Co., foot of Wayne Street, Erie, Pa., has let general contract to Sessinghaus & Ostergaard, Inc., 1115 Peach Street, for one-story machine shop, 50 x 120 ft. Cost about $40,000 with equipment.

Dravo Contracting Co., Neville Island, Pittsburgh, has approved plans for one-story addition, 156 x 210 ft., primarily an assembling shop for welded steel hulls for barges and other river boats. Installation will include 5 to 20-ton traveling cranes, transfer carriages and other equipment. Cost over $100,000 with machinery.

United States Engineer Office, Huntington, W. Va., asks bids until Dec. 28 for one gate latch complete for lower lock gates (Circular 84).

MICHIGAN DISTRICT

American Blower Corp., 6000 Russell Avenue, Detroit, has approved plans for one-story addition to plant at Dearborn, Mich., used largely for air-conditioning and industrial heating equipment production. Cost about $150,000 with equipment. Superstructure will begin in January.

Decker & Wilcox Mfg. Co., Hillsdale, Mich., manufacturer of screw products, automotive parts, etc., has leased a one-story industrial building at North Adams, Mich., for new branch works.

Pontiac Varnish Co., Pontiac, Mich., has taken out a permit for one-story addition to paint, varnish and oil-manufacturing plant, for which general contract recently was let to Harlan S. Smith, Pontiac. Cost close to $45,000 with equipment.

Ford Motor Co., Dearborn, Mich., has authorized further expansion in branch plant at Windsor, Ont., operated in name of Ford Motor Co. of Canada, Ltd., in addition to project recently noted in these columns, comprising large one-story unit for body-manufacturing division. Cost about $3,300,000 with machinery, making total expansion to be carried out in 1937 close to $5,000,000. Production facilities in all divisions will be increased about 25 per cent.

Manistee & Northeastern Railway Co., Manistee, Mich., plans rebuilding part of local engine house and repair shops recently destroyed by fire. Loss over $125,000 with equipment. J. Gordon Johnson is general manager.

OHIO AND INDIANA

Brewing Corp. of America, Inc., East Ninety-third Street and Quincy Road, Cleveland, has asked bids on general contract for four-story and basement addition, 96 x 106 ft., for expansion in brewing and fermenting departments, storage and distribution. Cost close to $100,000 with equipment. Ernest McGeorge, 1900 Euclid Avenue, is architect and engineer.

Goodyear Tire & Rubber Corp., Akron, Ohio, has acquired East End plant of Kelsey-Hayes Wheel Co., Jackson, Mich., consisting of 38 acres with group of one and multi-story buildings. Structures will be remodeled for new branch mill for production of automobile tires and tubes. Cost close to $800,000 with equipment.

Cedar Valley Distillery Co., Wooster, Ohio, has asked bids on general contract for one-story addition for storage and distribution. Company will call for bids soon for a second one-story extension, primarily for mechanical-bottling department. Entire project will cost over $70,000 with equipment. W. A. Neate, Wooster, is architect.

Plating & Galvanizing Co., 12010 Broadway, Cleveland, manufacturer of metal products, has plans for one-story addition, 50 x 125 ft. Cost close to $50,000 with equipment. H. W. Maurer, 3126 Scarboro Road, is architect.

Contracting Officer, Material Division, Army Air Corps, Wright Field, Dayton, Ohio, asks bids until Dec. 29 for screws and nuts (Circular ARL-18); until Jan. 4, oxygen regulator assemblies in lots of 400 to 2250 (Circular 391), vacuum type pump assemblies in lots of 500 to 1000 (Circular 388), screw terminal strips, condensers, transformers, sockets, mountings, resistors, potentiometers and other equipment (Circular ARL-19), 200 engine primer assemblies (Circular 382), 100 gun mount adapter yoke assemblies (Circular 403).

Board of Public Works, City Hall, Evansville, Ind., asks bids on general contract until Jan. 5 for one-story municipal service, repair and garage building, 269 x 270 ft., for city-owned trucks and cars. Cost about $80,000 with equipment. L. A. Geupel, City Hall, is city engineer; Fowler & Legemen, Central Union Building, are architects.

Reilly Tar & Chemical Corp., Merchants Bank Building, Indianapolis, has let general contract to Hunkin-Conkey Construction Co., 1740 East Twelfth Street, Cleveland, for branch plant on Independence Road, Cleveland. Cost about $100,000 with equipment. H. R. Warner is company engineer.

Early & Daniel Co., Chamber of Commerce Building, Cincinnati, grain and feed, plans addition to grain elevator in Fairmont district, work to be carried out early in 1937. Cost about $150,000 with elevating, conveying, screening and other mechanical equipment.

MIDDLE WEST

Tuthill Pump Co., 131 West Sixty-third Street, Chicago, manufacturer of oil pumps and parts, has purchased former plant of Zerozone Co., 925 East Ninety-fifth Street, comprising 14-acre tract, improved with one and two-story buildings, totaling 46,000 sq. ft. floor space, and will improve for main works for parts production and assembling.

Atwood Vacuum Machinery Co., 2500 North Main Street, Rockford, Ill., manufacturer of special machinery and parts, has let general contract to Security Build-

ing Co., 717 East Jefferson Street, for second-story addition to present one-story plant, 144 x 250 ft. Cost over $85,000 with equipment.

Mankato Brewing Co., Rock Street, Mankato, Minn., has asked bids on general contract for three-story addition, 60 x 75 ft., for a mechanical bottling works. Cost over $50,000 with machinery.

United States Engineer Office, Fort Peck, Mont., asks bids until Jan. 4 for two diesel engine-driven, crawler type, dragline excavators for handling a load of 10,600 lb. at boom radius of 50 ft., including 60-ft. boom (Circular 280).

Holly Sugar Corp., Colorado Springs, Colo., is completing plans for main unit of new beet sugar mill at Hardin, Mont., where large tract recently was selected, to be one and multi-story, 80 x 285 ft. Other structures will be built, including storage and distributing buildings, power house, and machine shop. Entire project will cost over $1,000,000 with equipment.

Purchasing Agent, Bureau of Reclamation, Denver, asks bids until Dec. 28 for cable, cable terminators, copper tubing, insulator pins and other equipment (Proposal A-5653).

Stewart-Warner Corp., 1828 West Diversey Parkway, Chicago, manufacturer of automotive equipment, electric refrigerator units, etc., has leased 70,000 sq. ft. in three-story building at Evergreen Avenue and Kingsbury Street for expansion, particularly in connection with electric refrigerator production.

Milwaukee Valve Co., 2375 South Burrell Street, Milwaukee, manufacturer of heating systems, brass castings, etc., contemplates erection of new foundry to replace old frame shop, 100 x 300 ft., badly damaged by fire on Dec. 14, with estimated loss of $75,000. Damage to furnaces and patterns was heaviest.

Hudson Mfg. Co., Minneapolis, manufacturer of agricultural tools and supplies, has plans by Auler, Jensen & Brown, 46 Washington Boulevard, Oshkosh, Wis., for addition to foundry of branch works at Oshkosh.

Pittsburgh Plate Glass Co., 235 East Pittsburgh Avenue, Milwaukee, has placed general contract to W. W. Oeflein, Inc., 312 East Wisconsin Avenue, for erection of new enamel plant to cost $250,000. Eschweiler & Eschweiler, 720 East Mason Street, Milwaukee, are architects.

◀ PACIFIC COAST ▶

General Electric Co., 5441 East Fourteenth Street, Oakland, Cal., has let general contract to Austin Co. of California, Inc., 516 Eighteenth Street, for one-story factory branch, storage and distributing plant on local site. Cost about $85,000 with equipment.

Security National Aircraft Co., Municipal Airport, Long Beach, Cal., has let general contract to Ted R. Cooper Co., Western Pacific Building, Los Angeles, for one and two-story airplane hangar, 50 x 160 ft., with shop and repair facilities.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Jan. 5 for 12 motor-driven, portable exhauster type ventilating sets (Schedule 9527) for Mare Island Navy Yard; 15 air turbine-driven portable blowers (Schedule 9512), three motor-driven wood band saws (Schedule 9514), one motor-driven double-spindle pipe-threading machine and one motor-driven single-spindle pipe and bolt-threading machine (Schedule 9510) for Puget Sound yard.

Goetz Breweries, Inc., 1107 Pearl Street, Spokane, Wash., has acquired building of Gilt Top Brewery Co., 901 Broadway, and will remodel for expansion. Cost about $70,000 with equipment. H. C. Bertelsen, Arthur D. Jones Building, is architect.

United States Engineer Office, Second District, Pittock Block, Portland, Ore., asks bids until Dec. 29 for power distribution equipment for Bonneville project, Bonneville, Ore., including battery-charging switchboard, lighting switchboard, four power cubicles, power cabinets, heater cabinets and other equipment.

Milwaukee Brewing Co., Tenth and Bryant Streets, San Francisco, will ask bids soon on general contract for three-story and basement mechanical-bottling and canning unit. Cost close to $90,000 with equipment. W. E. Murray, 908 Hayes Street, is architect and engineer.

Kaymo Electric Speed Boat Co., 630 Westlake Avenue, Los Angeles, manufacturer of motorboats, is considering new one-story plant at Newport Beach, Cal., to include parts production and assembling. Cost over $50,000 with equipment.

Harbor Plywood Corp., Port Terminal, Aberdeen, Wash., has let general contract to John B. Lamb Co., Aberdeen, for one-story mill addition. Cost about $130,000 with machinery, which will be electric-operated.

◀ FOREIGN ▶

Champion Spark Plug Co., 900 Upton Avenue, Toledo, has approved plans for new plant at Middlesex, England; superstructure to begin soon. Cost close to $500,000 with equipment.

Eburite Corrugated Containers, Ltd., Park Royal, N.W., London, England, has plans for new branch plant at Doncaster, England, including power house. Cost about $450,000 with equipment.

La Consolidada, Ltd., Mexico, D.F., manufacturer of iron and steel products, has plans for new mill at Piedras Negras, Coahuila State, Mexico, with power house, machine shops and other departments. Cost 1,500,000 pesos (about $320,000) with equipment.

Study Published Of Steel Industry

A NEW basic industrial study of the iron and steel industry of the United States which has for its purpose the location and measurement of this large market for manufacturers who sell to the industry has been published by the marketing research division of the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington.

In the foreword is stated that industrial marketing executives who fail to get an actual visual picture of their markets often commit serious errors in sales planning and promotion. "This is especially true of industries which supply basic production groups with large quantities of machinery, equipment and supplies, and which have too often established their sales quotas on the basis of inaccurate, incomplete, and other haphazard information on the market—its location, density, and its potential capacity to consume their products."

Accordingly the editors have compiled their statistics into tables, and in addition have based maps upon these tables, which show the location and density of each section of the industry by the type of material produced and by states and counties. It is believed that these maps will, when combined with the tables, offer new, definite and accurate material for the measurement of the iron and steel industry not heretofore generally available in such concise form. They are intended to be of aid in establishing sales territories, while the actual budgeting of expenses and the setting of sales quotas must be based on the tabular data.

"With the aid of the maps and the data included in the statistical tables," according to the text, "the sales executive can definitely organize his selling efforts to get the maximum results at a minimum cost. A study of the maps showing the location of the group in which the marketing executive is particularly interested will indicate just where his efforts should be concentrated, and will also show smaller outlying production centers which might be profitably covered by manufacturers' agents or by selling organizations other than his own salesmen.

"The final quota will be qualified by many other factors, such as current business conditions, apparent immediate future business conditions; the cost and usefulness of his own merchandise; and the amount and vigor of his competition, as well as conditions peculiar to the organization and operation of his own company."

The tables of production-capacity figures were obtained from the Directory of Iron and Steel Works, 1935, of the American Iron and Steel Institute. Tables dealing with the number of wage earners and the total wages paid by the industry are from the records of the National Recovery Administration.

Statistical data are complete and are broken down in a manner which will allow manufacturers of specialty equipment and apparatus to segregate that part of the market in which they are particularly interested.

A new line of enamels developed by Maas & Waldstein Co., Newark, will, when mixed with clear lacquers, give a clear, brilliant, transparent colored effect to metals of all kinds that is said to be fast to light and very durable, according to a statement from that company. This new type enamel is known as "Platelustre" and is supplied in a large assortment of colors, permitting the reproduction of all popular chemical metal coloring effects, as well as making possible new effects, without the use of chemical processes. It is said to be especially suitable for compacts, lighting fixtures, novelties, casket hardware and other products where a brilliant colored metallic finish is desired.

Of course you wouldn't give Wyandotte as a Christmas present to your family or friends. But while you're enjoying a Merry Christmas in your home don't forget to give your business a Christmas present, too. Give it Wyandotte, and your business, and you, will enjoy a Happy and Prosperous New Year.

SEASON'S GREETINGS

THE J. B. FORD COMPANY · WYANDOTTE, MICH.

"Marsh Buggy," An Unusual Vehicle, Runs Equally Well On Land Or Water

ONE of the strangest conveyances ever devised by man was recently put into service by the Gulf Oil Corp. in Bayou Lafourche, near Golden Meadow, La. Known as a "marsh buggy," this vehicle was built to carry geophysicists and surveyors over extremely boggy country—the type of country which could be traversed by neither boat nor automobile—but under this wasteland often lies domes of solid ground in which oil is found.

The most prominent feature of the marsh buggy is the set of four tires with which it is equipped. These tires, able to support the vehicle in deep water, are 10 ft. in diameter, 33½ in. across and the rims on which they are mounted are 66 in. in diameter. The sheet aluminum wheels are actually tanks of sufficient displacement to keep the vehicle afloat even if all the tires are deflated. The tires, made by the Goodyear Tire & Rubber Co., are four-ply and are the largest ever to be constructed for commercial purposes.

Traction is obtained by detachable tread links, 12 to each wheel, made of 2-in. outside diameter water hose. These tread links are airtight and are inflated to 25 lb. pressure to keep them from flattening out. When in water, they act as paddles.

Powerplant is a Ford V-8 engine, pleasure car type, with special cooling facilities, for the marsh buggy often has to work to temperatures of 100 deg. F. and over. Two transmissions provide 10 operating speeds forward and six in reverse. Speeds range from ½ m.p.h. to 35 m.p.h. No springs are necessary because of the springiness of the tires.

Constructed mainly of aluminum and stainless steel alloys, the vehicle weighs without load 7500 lb. and is designed to carry a load of 1000 lb. including crew and instruments. Weight distribution and buoyancy are such that it is practically impossible to tip the buggy over in deep water, even when high winds prevail. When in the water there is 1 ft. 9 in. clearance between water and the bottom of the chassis, which clears the ground by 4 ft.

ABOVE

THIS strange-looking vehicle, called a marsh buggy, operates equally well on land or water and was designed for use in the swamp lands for oil prospecting.

AT LEFT

HERE is shown the marsh buggy with the front wheels taking to the water and the rear wheels still on land.

o o o

The original idea for the vehicle was that of A. A. Lane, Gulf mechanical engineer, while the detailed design was done jointly by Lane and E. W. Jacobson, assistant engineer, under the general supervision of R. J. S. Pigott, staff engineer. Wheels were fabricated by Goodyear Zeppelin Corp. and the vehicle was assembled in the Gulf Research Laboratory shops at Harmarville, Pa.

JUST BETWEEN US TWO

Predestination

NO bacteriologist studies his bugs, or, to use a happier and loftier comparison, no astronomer observes the heavens more searchingly than Frank J. Oliver, our Detroit editor, eyes the goings-on in the automotive industry.

Frank, who fathers the scintillating *"On the Assembly Line,"* notes that in General Motors' new Grand Rapids stamping plant the resident comptroller is Glenn S. Cashdollar.

Papa Knows Best

THE benighted who crawl along painfully for a time without the helping hand of The Iron Age are not permitted the partial solace afforded by ignorance of a cure. We keep reminding them that they have only themselves to blame.

One of our reminderers, Joe Fuller, has an O. Henry knack of packing punches into his reports. A visit to a small Detroit plant brings this:

"He's about 60, but he'll have to speak to his dad first."

Paragon

AN Iron Age village at Meare, near Glastonburg, has been unearthed by English archaeologists. *The London Morning Post* reports:

"The archaeologists have been able to prove that the later Iron Age man—known as the Iron Age 'B' man—was proficient in basket and pottery making, that he grew wheat and made bread, that he was a skilled carpenter and metallurgist, that he was a weaver, that he could chisel a canoe from the trunk of an oak . . . ."

And we can't even chisel a raise from the Oberleutnant. Backward, turn backward, time in your flight and make us a "B" man for just about twenty minutes.

Coals of Fire

WE are no more accurate than we should be in list-checking and frequently insult subscribers by addressing them as if they were among the benighted. One of the big stove manufacturers who was recently affronted says:

"We have been using The Iron Age since we started in business over 40 years ago and would not be without it."

Problem

WILL the contemptuous eighteen who have been aspersing the problems appearing here focus their sapient cerebrums on this one. Reader No. 13, Norvin E. Green, President, Louisville Car Wheel & Railway Supply Co., sent it in. He clipped it from Bruce Dudley's coruscating column in the Louisville *Courier-Journal:*

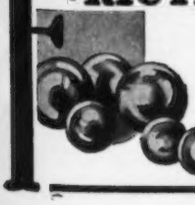
A flagpole perfectly round is 18 in. in dia. at the base, is 50 ft. tall, and tapers to 5 in. dia. at the top. A ribbon 2 in. wide is wound around the pole starting at the base and overlapping 1 in. When it reaches the top a bird seizes it and unwinds it, keeping the ribbon taut at all times. How far does the bird fly?

Samaritan

A WEEK or so ago we mourned publicly that we were out of copies of the Oct. 15 issue. W. Q. Phillips of the Doherty Mfg. Co., Ltd., Sarnia, Canada, rushed us his copy with a note, "Bis dat qui cito dat." To which we respond, with the help of a list of Latin quotations, "Omne bonum desuper."

To all but the mercenary Advertising Department, which curtailed our space, a Merry Christmas! —A.H.D.

"METALINE"
(REGISTERED TRADE MARK)
OILLESS BRONZE BEARINGS
R. W. RHOADES METALINE CO., INC.
43—3RD ST. LONG ISLAND CITY, N. Y.


FRICTION FEARS THIS FOE
Rely on Abbott for steel balls in precision and commercial tolerances.
THE ABBOTT BALL COMPANY
1047 New Britain Ave., Hartford, Conn.
ABBOTT BEARING BALLS

Products Index

ABRASIVE WHEELS—See Grinding Wheels

ABRASIVE CLOTH & PAPER
Norton Co., Worcester, Mass.

ABRASIVES—Steel Shot and Grit
American Foundry Equipment Co., The, 401 Byrkit St., Mishawaka, Ind.
Pangborn Corporation, Hagerstown, Md.

ACCUMULATORS—Hydraulic
Baldwin-Southwark Corp., Southwark Div., Philadelphia.
Lake Erie Engineering Corp., 68 Kenmore Sts., Buffalo, N. Y.
Wood, R. D., & Co., Philadelphia.

ACETYLENE—Dissolved in Cylinders & Small Tanks
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

ACID-PROOF CONSTRUCTION
Atlas Mineral Prods. Co. of Pa., The, Mertztown, Pa.

ACIDS—Pickling
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AIR CONDITIONING EQUIPMENT
Clarage Fan Co., Kalamazoo, Mich.

AIR TANKS AND CYLINDERS
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ALLOYS—Calcium
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

ALLOYS—Copper
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ALLOYS—Magnesium
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

ALLOYS—Phosphor Bronze
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ALLOYS—Tungsten
Vanadium Corp. of America, 420 Lexington Ave., N. Y. C.

ALLOYS—Vanadium
Vanadium Corp. of America, 420 Lexington Ave., N. Y. C.

ALUMINUM
Seligman, Arthur, & Co., Inc., 30 Rockefeller Plaza, R. C. A. Bldg., N. Y. C.

AMMETERS AND VOLTMETERS—Recording
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AMMONIA RECOVERY PLANTS
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Columbia Steel Co. (U. S. Steel Corp. Subsidiary), San Francisco, Calif.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Ryerson, Jos. T., & Son, Inc., Chicago.
Scully Steel Products Co. (U. S. Steel Corp. Subsidiary), Chicago.
Steel & Tubes, Inc., Cleveland.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.
Weirton (W. Va.) Steel Co.

ANGLES, BEAMS, CHANNELS & TEES—Magnesium Alloys
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

ANNEALING—See Heat Treating

ANNEALING BOXES
Lebanon (Pa.) Steel Foundry.
United Engineering & Fdry. Co., Ptgh.

ANNEALING COVERS
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ANODES—All Types
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Seymour (Conn.) Mfg. Co.
Udylite Co., The, Detroit.

ANODES—Cadmium
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Udylite Co., The, Detroit.

ANODES—Zinc
Meaker Co., The, Chicago.

ARBORS
Morse Twist Drill & Mch. Co., New Bedford, Mass.

ARMORING MACHINERY—Cable, Wire, Hose
Sleeper & Hartley, Inc., Worcester, Mass.

ARRESTERS—Spark
Harrington & King Perforating Co., Chi.

AXLES—Car or Locomotive
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.

BALANCING EQUIPMENT
Gisholt Machine Co., Madison, Wis.

BALING PRESSES—Scrap—See Presses—Baling

BALLS—Burnishing
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.
Hartford (Conn) Steel Ball Co., The.

BALLS—Steel, Brass or Bronze
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.
Fafnir Bearing Co., New Britain, Conn.
Hartford (Conn) Steel Ball Co., The.
New Departure Mfg. Co., Bristol, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.

BANDS—Steel
Acme Steel Co., Chicago.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.

BANDS—Welded
Amer. Welding & Mfg. Co., Warren, O.

BARRELS—Burnishing
Abbott Ball Co., The, 1047 New Britain Ave., Hartford, Conn.

BARRELS—Plating
Crown Rheostat & Supply Co., Chicago, Ill.
Meaker Co., The, Chicago.

BARRELS—Tumbling
Baird Mch. Co., The, Bridgeport, Conn.
Hartford (Conn) Steel Ball Co., The.

BARS—Alloy
Republic Steel Corp., Cleveland, Ohio.

BARS—Brass, Bronze or Copper
Bunting Brass & Bronze Co., Toledo, Ohio.

BARS—Cold Drawn
American Steel & Wire Co. (U. S. Steel Corp. Subsidiary), Chicago.
Union Drawn Steel Co., Massillon, Ohio.

BARS—Concrete, Reinforcing
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.
Columbia Steel Co. (U. S. Steel Corp. Subsidiary), San Francisco, Calif.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Laclede Steel Co., St. Louis, Mo.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.

BARS—Magnesium Alloys
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

BARS—Steel
Ames, W., & Co., Jersey City, N. J.
Andrews Steel Co., The, Newport, Ky.
Bethlehem (Pa.) Steel Company.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.
Great Lakes Steel Corp., Detroit.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Republic Steel Corp., Cleveland, Ohio.
Scully Steel Products Co. (U. S. Steel Corp. Subsidiary), Chicago.
Steel & Tubes, Inc., Cleveland.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.
Timken Roller Bearing Co., The, Canton, O.
Timken Steel & Tube Co., The, Canton, O.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co., The.

BATTERIES—Storage
Edison Storage Battery, Div. of Thomas A. Edison, Inc., West Orange, N. J.
Electric Storage Battery Co., The, Phila.

BATTERY CHARGERS
Cutler-Hammer, Inc., Milwaukee.

BEAMS—See Angles, Beams, Channels and Tees

BEARINGS—Ball
Bantam Ball Bearing Co., The, South Bend, Indiana.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., The, Poughkeepsie, N. Y.
New Departure Mfg. Co., Bristol, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Schatz Mfg. Co., Poughkeepsie, N. Y.

BEARINGS, Brass and Bronze
Ampco Metal, Inc., Milwaukee, Wis.
Bunting Brass & Bronze Co., Toledo, O.

BEARINGS—Oilless
Bunting Brass & Bronze Co., Toledo, O.
Rhoades, R. W., Metaline Co., Inc., Long Island City, N. Y.
Richardson Co., The, Melrose Park, Ill.

BEARINGS—Quill
Bantam Ball Bearing Co., The, South Bend, Indiana.

BEARINGS—Radial
Bantam Ball Bearing Co., The, South Bend, Indiana.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., The, Poughkeepsie, N. Y.
Hyatt Roller Bearing Co., Newark, N. J.
New Departure Mfg. Co., Bristol, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
Shafer Bearing Corp., Chicago.

BEARINGS—Roll Neck
Bantam Ball Bearing Co., The, South Bend, Indiana.
Morgan Construction Co., Worcester, Mass.
S K F Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Shafer Bearing Corp., Chicago.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Roller
Bantam Ball Bearing Co., The, South Bend, Indiana.
Hyatt Roller Bearing Co., Newark, N. J.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Shafer Bearing Corp., Chicago.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Roller Tapered
Bantam Ball Bearing Co., The, South Bend, Indiana.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Rolling Mill Equipment
Bantam Ball Bearing Co., The, South Bend, Indiana.
Richardson Co., The, Melrose Park, Ill.
S K F Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Timken Roller Bearing Co., The, Canton, O.

BEARINGS—Self-aligning Roller
Shafer Bearing Corp., Chicago.

Products Index

BEARINGS—Shaft Hanger
Fafnir Bearing Co., New Britain, Conn.
Hyatt Roller Bearing Co., Newark, N. J.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Shafer Bearing Corp., Chicago.

BEARINGS—Thrust
Bantam Ball Bearing Co., The, South Bend, Indiana.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., The, Poughkeepsie, N. Y.
Hyatt Roller Bearing Co., Newark, N. J.
New Departure Mfg. Co., Bristol, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Phila., Pa.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
Shafer Bearing Corp., Chicago.
Timken Roller Bearing Co., The, Canton, O.

BELT DRESSING
Graton & Knight Co., Worcester, Mass.
Rhoads, J. E., & Sons, Philadelphia.

BELT FASTENERS
Bristol Co., The, Waterbury, Conn.
Graton & Knight Co., Worcester, Mass.

BELT LACER
Bristol Co., The, Waterbury, Conn.

BELT LACING
Graton & Knight Co., Worcester, Mass.
Rhoads, J. E., & Sons, Philadelphia.

BELT—Conveyor, Elevator
Goodrich, B. F., Co., The, Akron, Ohio.
Graton & Knight Co., Worcester, Mass.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.

BELTING CEMENT
Graton & Knight Co., Worcester, Mass.
Rhoads, J. E., & Sons, Philadelphia.

BELTING—Leather
Chicago (Ill.) Rawhide Mfg. Co., The, 1306 Elston Ave.
Graton & Knight Co., Worcester, Mass.
Houghton, E. F., & Co., Philadelphia.
Rhoads, J. E., & Sons, Philadelphia.

BELTING—Metal, Conveyor, High and Low Temperature
Acme Steel Co., Chicago, Ill.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

BELTING—Rubber
Goodrich, B. F., Co., The, Akron, Ohio.
Goodyear Tire & Rubber Co., Akron, Ohio.
Graton & Knight Co., Worcester, Mass.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.
Robins Conveying Belt Co., 15 Park Row, N. Y. C.

BELTS—V-Type
Allis-Chalmers Mfg. Co., Milwaukee.
Graton & Knight Co., Worcester, Mass.
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.

BENDING MACHINES—Hand, Band and Angle
Exceistor Tool & Mch. Co., E. St. Louis, Ill.

BENDING MACHINES—Hand and Power
Cincinnati (Ohio) Shaper Co., The.
Dreis & Krump Mfg. Co., Chicago.
Niagara Machine & Tool Works, Buffalo, N. Y.

BENZOL RECOVERY PLANTS
Koppers Construction Co., The, Pittsburgh.

BERYLLIUM COPPER
American Brass Co., The, Waterbury, Conn.
Riverside (N. J.) Metal Co.

BILLETS—Alloy Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Carbon Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Carbon Vanadium Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Chrome Nickel Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Chrome Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Die Block Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Forging
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.
Central Iron & Steel Co., Harrisburg, Pa.
Harrisburg (Pa.) Steel Corp.
Midvale Co., The, Nicetown, Phila., Pa.
Republic Steel Corp., Cleveland, Ohio.

BILLETS—Nickel Steel
Andrews Steel Co., The, Newport, Ky.

BILLETS—Re-rolling
Alan Wood Steel Co., Conshohocken, Pa.
Andrews Steel Co., The, Newport, Ky.

BILLETS—Steel
Bethlehem (Pa.) Steel Company.
Continental Steel Corp., Kokomo, Ind.
Tennessee Coal, Iron & Railroad Co. (U. S. Steel Corp. Subsidiary), Birmingham, Ala.

BLANKS—Chisel
Cleveland Steel Tool Co., The, 660 E. 82nd St., Cleveland, Ohio.

BLANKS—Gear and Pinion
Chicago (Ill.) Rawhide Mfg. Co., The, 1306 Elston Ave.
Richardson Co., The, Melrose Park, Ill.

BLAST FURNACES
Brassert, H. A., & Co., Chicago, Ill.

BLAST GATES
Rockwell, W. S., Co., 50 Church St., N. Y. C.

BLOCKS—Chain
Yale & Towne Mfg. Co., The, Phila. Div., Phila., Pa.

BLOWERS
Clarage Fan Co., Kalamazoo, Mich.
Spencer Turbine Co., Hartford, Conn.

BLOWPIPES—Oxy-Acetylene Welding & Cutting
Linde Air Prods. Co., The, 30 E. 42nd St., N. Y. C.
Weldit Acetylene Co., Detroit.

BLOWPIPES — Soldering, Heating, Annealing
American Gas Furnace Co., Elizabeth, N.J.
Weldit Acetylene Co., Detroit.

BOILERS—Waste Heat
Babcock & Wilcox Co., The, 85 Liberty St., New York City.

BOILERS—Water Tube
Babcock & Wilcox Co., The, 85 Liberty St., New York City.

BOLT CUTTERS
Landis Mch. Co., Inc., Waynesboro, Pa.

BOLT AND NUT MACHINERY
Landis Machine Co., Inc., Waynesboro, Pa.
Manville, E. J., Mch. Co., Waterbury, Ct.
Waterbury (Ct.) Farrel Fdry. & Mch. Co.

BOLT & RIVET CLIPPERS
Bremil Mfg. Co., Erie, Pa.
Helwig Mfg. Co., St. Paul, Minn.

BOLTS—Carriage and Machine
Cleveland (Ohio) Cap Screw Co., The.
Erie (Pa.) Bolt & Nut Co.
Republic Steel Corp., Upson Nut Div., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS—Special
Erie (Pa.) Bolt & Nut Co.
Republic Steel Corp., Upson Nut Div., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS—Stove
Blake & Johnson Co., The, Waterville, Ct.

BOLTS—Track
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.
Republic Steel Corp., Upson Nut Div., Cleveland, O.

BOLTS AND NUTS
Ames, W., & Co., Jersey City, N. J.
Clark Bros. Bolt Co., Milldale, Conn.
Erie (Pa.) Bolt & Nut Co.
Heiz & Heiz, Inc., 33—34th St., Brooklyn, N. Y.
Oliver Iron & Steel Corp., Pittsburgh.
Republic Steel Corp., Cleveland, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOND—Grinding Wheel
Bakelite Corp., 247 Park Ave., N. Y. C

BORING—Hollow
American Hollow Boring Co., 1912 Raspberry St., Erie, Pa.

BORING BARS
Bullard Co., The, Bridgeport, Conn.

BORING, DRILLING & MILLING MACHINES—Horizontal
Hill-Clarke Mchry. Co., 647 W. Washington Blvd., Chicago.
Lucas Machine Tool Co., Cleveland.
National Automatic Tool Co., Richmond, Ind.

BORING & DRILLING MACHINES—Vertical
Baker Bros., Inc., Toledo, Ohio.
Bullard Co., The, Bridgeport, Conn.

BORING MACHINES—Diamond
Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit.

BORING MACHINES—Diamond & Carbide Tools
Herld Mch. Co., Worcester, Mass.

BORING MACHINES—Jig
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

BORING & TURNING MILLS—Vertical
Bullard Co., The, Bridgeport, Conn.
Cincinnati (Ohio) Planer Co.

BOX STRAPPING
Acme Steel Co., Chicago, Ill.

BOXES—Steel
Berger Mfg. Co., The, Canton, Ohio.

BRAKE LINING AND BLOCKS—Asbestos
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., The, 2 Townsend St., Passaic, N. J.

BRAKES—Electric
Cutler-Hammer, Inc., Milwaukee.

BRAKES—Electric & Mechanical
Clark Controller Co., The, Cleveland.
Electric Controller & Mfg. Co., The, Cleveland.

BRAKES—Magnetic
Stearns Magnetic Mfg. Co., 626 So. 28th St., Milwaukee.

BRAKES—Metal Forming
Cincinnati (Ohio) Shaper Co., The.
Dreis & Krump Mfg. Co., Chicago.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
Steelweld Machinery Co., Cleveland.

BRICK—Fire Clay
Carborundum Co., The, Niagara Falls, N. Y.
Illinois Clay Products Co., Joliet, Ill.

BRICK—Insulating
Babcock & Wilcox Co., The, 85 Liberty St., New York City.

BRIDGE BUILDERS
American Bridge Co. (U. S. Steel Corp. Subsidiary), Pittsburgh.
Belmont Iron Works, Philadelphia.

BRIDGE OPERATING MACHINERY—Movable
Earle Gear & Mch. Co., Philadelphia.

BROACHES
Colonial Broach Co., Detroit, Mich.

BROACHING MACHINES
Bullard Co., The, Bridgeport, Conn.
Cincinnati (Ohio) Milling Mch. Co., The.
Colonial Broach Co., Detroit, Mich.
Oilgear Co., The, 1311 W. Bruce St., Milwaukee.

BRONZE FOR DIES
Ampco Metal, Inc., Milwaukee, Wis.

BRONZE—Phosphor
Bunting Brass & Bronze Co., Toledo, Ohio.
Phosphor Bronze Smelting Co., The, Phila.
Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.

Products Index

Riverside (N. J.) Metal Co.
Seymour (Conn.) Mfg. Co.

BUCKETS—Clamshell
Erie (Pa.) Steel Construction Co.
Hayward Co., The, 50 Church St., N. Y. C.
Industrial Brownhoist Corp., Bay City, Mich.

BUCKETS—Electric Motor
Erie (Pa.) Steel Construction Co.
Hayward Co., The, 50 Church St., N. Y. C.

BUCKETS—Orange Peel
Erie (Pa.) Steel Construction Co.
Hayward Co., The, 50 Church St., N. Y. C.

BUFFERS & POLISHING MACHINES
Vonnegut Moulder Corp., 1807 Madison Ave., Indianapolis, Ind.

BUILDINGS—Steel
American Bridge Co. (U. S. Steel Corp. Subsidiary), Pittsburgh.
Belmont Iron Works, Philadelphia.
Bethlehem (Pa.) Steel Co.

BULLDOZERS
Beatty Mch. & Mfg. Co., 936—150th St., Hammond, Ind.
Steelweld Machinery Co., Cleveland.

BULLDOZERS—Hydraulic
Elmes, Chas. F., Engng. Wks., Chicago.

BURNERS—Oil or Gas
Wilson, Lee Engineering Co., The, Cleveland.

BUSHINGS—Bronze
Ampco Metal, Inc., Milwaukee, Wis.
Bunting Brass & Bronze Co., Toledo, O.
Phosphor Bronze Smelting Co., The, Phila.
Shenango-Penn Mold Co., Pittsburgh.

BUSHINGS—Oilless
Rhoades, R. W., Metaline Co., Inc., Long Island City, N. Y.

BUSHINGS—Phosphor Bronze
Bunting Brass & Bronze Co., Toledo, Ohio.
Phosphor Bronze Smelting Co., The, Phila.

BY-PRODUCTS COKE AND GAS OVENS
Koppers Construction Co., The, Pittsburgh.

CABLE—Electric
General Electric Co., Schenectady, N. Y.
Simplex Wire & Cable Co., Cambridge A, Boston, Mass.

CABLEWAYS AND TRAMWAYS — See Tramways

CADMIUM
Du Pont de Nemours, E. I., & Co., Inc., Grasselli Chemicals Dept., Wilmington, Del.
Udylite Co., The, Detroit.

CADMIUM PLATING PROCESS
Du Pont de Nemours, E. I., & Co., Inc., Grasselli Chemicals Dept., Wilmington, Del.
Udylite Co., The, Detroit.

CARBIC
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

CARBIDE
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

CARBIDE—Boron
Norton Co., Worcester, Mass.

CARBURIZING—See Heat Treating

CARS—Industrial and Mining
Atlas Car & Mfg. Co., The, Cleveland.
Bartlett, C.O., & Snow Co., The, Cleveland.

CASE HARDENING—See Heat Treating

CASTINGS—Acid or Heat Resisting
American Manganese Steel Co., Chicago Heights, Ill.
Ampco Metal, Inc., Milwaukee, Wis.
Duriron Co., Inc., The, 438 N. Findlay St., Dayton, Ohio.
Hoskins Mfg. Co., Detroit, Mich.
Lebanon (Pa.) Steel Foundry.
Midvale Co., The, Nicetown, Phila., Pa.

CASTINGS—Alloy Steel
Bissett Steel Co., The, Cleveland.
Lebanon (Pa.) Steel Foundry.
Mackintosh-Hemphill Co., Pittsburgh.
Midvale Co., The, Nicetown, Phila., Pa.

CASTINGS—Brass, Bronze, Copper or Aluminum
Cadman, A. W., Mfg. Co., Pittsburgh.
Carbon Malleable Casting Co., Inc., Lancaster, Pa.
Phosphor Bronze Smelting Co., The, Phila.
Snyder, W. P., & Co., Pittsburgh.
Spencer's, I. S., Sons, Inc., Guilford, Ct.

CASTINGS—Corrosion Resisting
American Manganese Steel Co., Chicago Heights, Ill.
Midvale Co., The, Nicetown, Phila., Pa.

CASTINGS—Electric Steel
Industrial Steel Casting Co., The, Toledo.
Lebanon (Pa.) Steel Foundry.

CASTINGS—Gray Iron
Cheney, S., & Son, Manlius, N. Y.
Dubois (Pa.) Iron Works.
Midvale Co., The, Nicetown, Phila., Pa.
National Roll & Fdry. Co., Avonmore, Pa.
North Wales (Pa.)) Mach. Co., Inc.
Spencer's, I. S., Sons, Inc., Guilford, Ct.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.

CASTINGS—Magnesium Alloys
Dow Chemical Co., 921 Jefferson Ave., Midland, Mich.

CASTINGS—Malleable
Carbon Malleable Casting Co., Inc., Lancaster, Pa.
Lake City Malleable Co., The, 5100 Lakeside Ave., Cleveland.
Malleable Iron Fittings Co., Branford, Ct.
Peoria (Ill.) Malleable Castings Co.

CASTINGS—Manganese Steel
American Manganese Steel Co., Chicago Heights, Ill.

CASTINGS—Monel & Nickel
Superior Bronze Corp., Erie, Pa.

CASTINGS—Semi-Steel
Malleable Iron Fittings Co., Branford, Ct.

CASTINGS—Steel
Bethlehem (Pa.) Steel Company.
Carnegie-Illinois Steel Corp. (U. S. Steel Corp. Subsidiary), Pittsburgh & Chicago.
Columbia Steel Co. (U. S. Steel Corp. Subsidiary), San Francisco, Calif.
Crucible Steel Castings Co., Lansdowne, Pa.
Industrial Steel Castings Co., The, Toledo.
Lebanon (Pa.) Steel Foundry.
Mackintosh-Hemphill Co., Pittsburgh.
Malleable Iron Fittings Co., Branford, Ct.
Mesta Mch. Co., Pittsburgh.
Midvale Co., The, Nicetown, Phila., Pa.

CEMENT—Acid Proof
Atlas Mineral Products Co. of Pa., The, Mertztown, Pa.

CEMENT—Quick Setting, Acid Proof & Insulator
Nukem Products Corp., 68 Niagara St., Buffalo, N. Y.

CEMENT—Refractory
Carborundum Co., The, Perth Amboy, N. J.

CEMENT—Rubber
Goodrich, B. F., Co., The, Akron, Ohio.

CHAINS—Conveyor & Elevator
Baldwin-Duckworth Chain Corp., Springfield, Mass.
Bartlett, C. O., & Snow Co., The, Cleveland.
Diamond Chain & Mfg. Co., Indianapolis, Ind.

CHAINS—Power Transmission
Baldwin-Duckworth Chain Corp., Springfield, Mass.
Boston Gear Works, Inc., North Quincy, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Co., Chicago.
Morse Chain Co., Ithaca, New York.
Whitney Chain & Mfg. Co., Hartford, Ct.

CHAINS—Roller
Baldwin-Duckworth Chain Corp., Springfield, Mass.
Bartlett, C. O., & Snow Co., The, Cleveland.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Co., Chicago.
Morse Chain Co., Ithaca, New York.
Whitney Chain & Mfg. Co., Hartford, Ct.

CHAINS—Silent
Link-Belt Co., Chicago.
Morse Chain Co., Ithaca, New York.
Whitney Chain & Mfg. Co., Hartford, Ct.

CHANNELS—See Angles, Beams, Channels and Tees

CHECKS—Metal
Noble & Westbrook Mfg. Co., The, East Hartford, Ct.

CHEMICALS—Industrial
Du Pont de Nemours, E. I., & Co., Inc., Grasselli Chemicals Dept., Wilmington, Del.

CHEMICALS—Rust Proofing
Alrose Chemical Co., Providence, R. I.
Bonding Process Corp., 10401 Northlawn Ave., Detroit.
Parker Rust-Proof Co., 2186 Milwaukee Ave., Detroit.
Udylite Co., The, Detroit.

CHROMIUM METAL & ALLOYS
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

CHROMIUM PLATING — See Plating-Chromium

CHUCKING MACHINES—Multiple Spindle
Baird Mch. Co., The, Bridgeport, Conn.
Goss & DeLeeuw Machine Co., The, New Britain, Conn.
National Acme Co., The, Cleveland.

CHUCKS—Air Operated
Hannifin Mfg. Co., Chicago.

CHUCKS—Drill
Cleveland (Ohio) Twist Drill Co., The.
Cushman Chuck Co., Hartford, Conn.
Morse Twist Drill & Mach. Co., New Bedford, Mass.

CHUCKS—Electric
Cushman Chuck Co., Hartford, Conn.

CHUCKS—Lathe
Cushman Chuck Co., Hartford, Conn.

CHUCKS—Magnetic
Heald Mch. Co., Worcester, Mass.
Taft-Peirce Mfg. Co., The, Woonsocket, R. I.

CIRCLES—Phosphor Bronze
Phosphor Bronze Smelting Co., The, Phila.
Revere Copper & Brass, Inc., 230 Park Ave., N. Y. C.
Riverside (N. J.) Metal Co.

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Detroit Rex Products Co., Detroit, Mich.
Ford, J. B., Co., The, Wyandotte, Mich.
Meaker Co., The, Chicago.
Nukem Products Corp., 68 Niagara St., Buffalo, N. Y.

CLEANING COMPOUNDS—Alkali
Detroit Rex Products Co., Detroit, Mich.

CLEANING EQUIPMENT—Metal
Detroit Rex Products Co., Detroit, Mich.
Meaker Co., The, Chicago.

CLEANING EQUIPMENT (Metal)—Electro-Chemical
Bullard Co., The, Bridgeport, Conn.
Meaker Co., The, Chicago.

CLEANING MATERIALS—Glass
Nukem Products Corp., 68 Niagara St., Buffalo, N. Y.

CLOTHING—Asbestos & Fireproof
Safety Equipment Service Co., The, Cleve.

CLUTCH-BRAKES—Magnetic
Stearns Magnetic Mfg. Co., 626 So. 28th St., Milwaukee.

CLUTCHES
Fairbanks, Morse & Co., Chicago.
Falls Clutch & Mchry. Co., The, Cuyahoga Falls, Ohio.
Hilliard Corp., The, Railroad Ave., Elmira, N. Y.
Medart Co., The, St. Louis, Mo.
Morse Chain Co., Detroit, Mich.
Morse Chain Co., Ithaca, New York.